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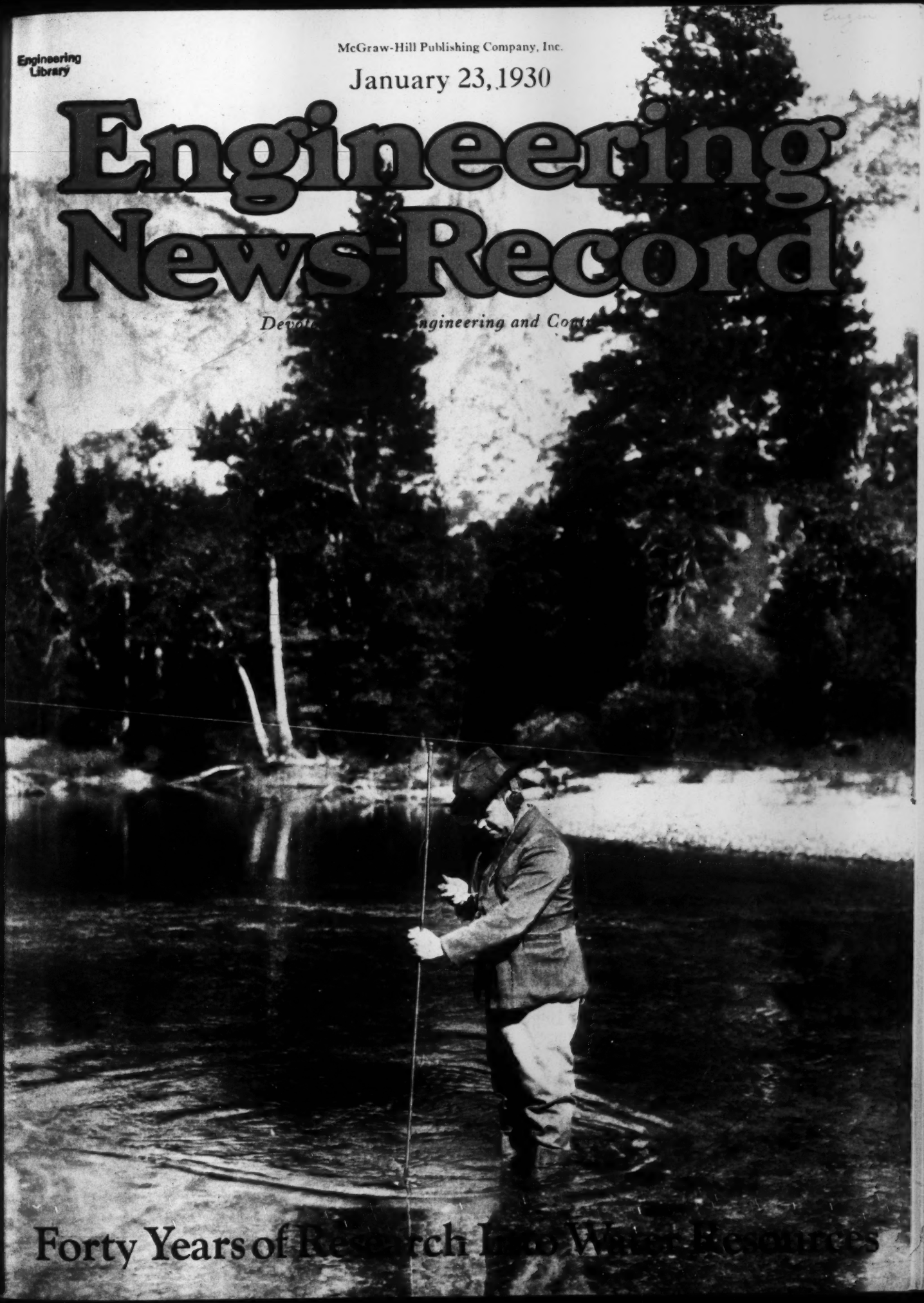

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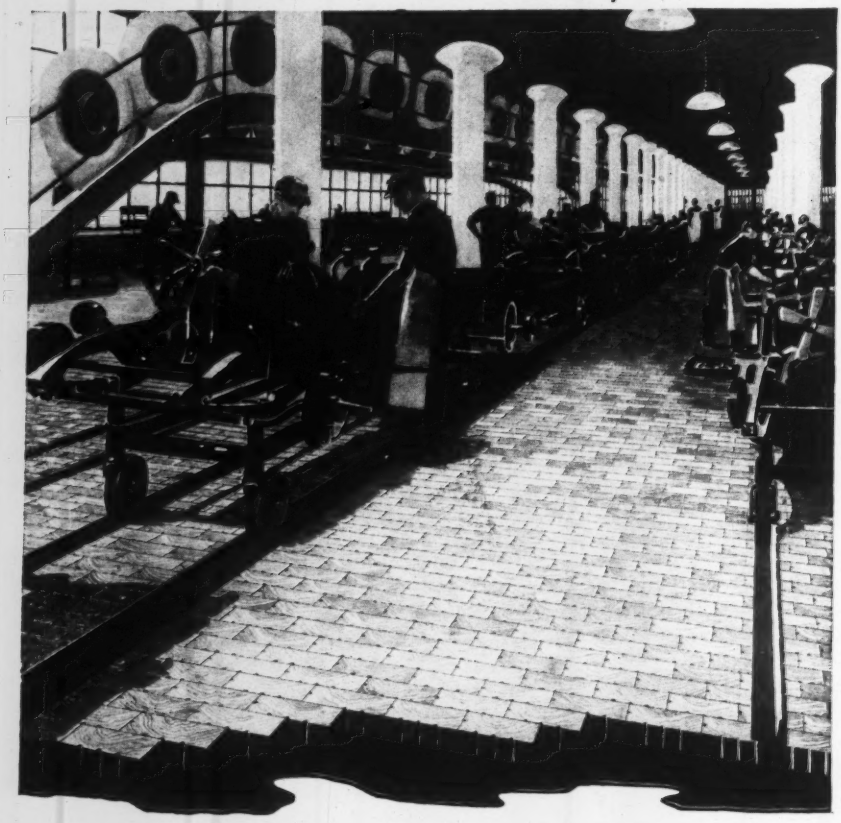

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Contents for January 23, 1930

VOLUME 104, NUMBER 4

Copyright, 1930, by McGraw-Hill Publishing Company, Inc.

Forty Years of Water Research 132
BY F. H. NEWELL

Progress in Highway Planning 137

Steel Frames for Houses 141
BY T. J. FOSTER

Heaviest Welded Steel Truss 144
BY H. J. WALLACE

Railway Developments in Japan 146

Pile Foundations for River Lights 147
BY C. F. GANONG

Supreme Court on Depreciation Allowance 148

Steel Erection Problems on 1,000-Ft. Building 149

Roof Trusses Support Floor Below 152

Planning a City Engineer's Office 153

Meeting of Am. Soc. C. E. 156

Equipment at Atlantic City Road Show 160

Editorial 129 News 165

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ENGINEERING NEWS-RECORD

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

F. E. SCHMITT, *Editor*

Volume 104 NEW YORK, JANUARY 23, 1930 Number 4

An Engineering Week

TWO great engineering conventions met last week, and it is natural that present reflections should center on their doings. The meetings enlisted the interest of the chief men in the field of civil engineering; the American Road Builders' Association, together with its great exhibition of road equipment, brought together groups quite as important as those assembled by the American Society of Civil Engineers. Both organizations had meetings of notable strength, yet in different ways each revealed the need for improvement before society conduct will attain the level of efficiency demanded of engineering work *per se*. The civil engineers, following custom, realized but one day of effective meeting out of a week's time, which, with late evenings, inevitably spelled low efficiency. The road builders, on the other hand, with an active program of reports and papers extending over four days, drew only small gatherings into their technical sessions. Here also the efficiency of the meeting was low, which is especially regrettable in view of the critical importance of many major highway problems at this time. As the road builders' association offers the only forum where all the parties involved can meet for discussion, the outstanding impression derived from the two meetings is that readjustment of the work of this body is urgently desirable. Road building is so vital an industry that its growing problems call for the most thorough consideration that can be provided.

Confusion From Overlap

A TEXT for a sermon, or perhaps for a questionnaire or similar modern device, might be found in the scheduling of a highway division session at the meeting of the American Society of Civil Engineers precisely while the American Road Builders' Association was in session in another city. With plenty of divisions in the former society to choose from, it would seem that some other divisional session could have been found instead. But the small attendance at the session of the highway division sufficiently pointed the lesson, and therefore the matter is of present interest only for its bearing on other elements of confusion in society relations. Confusion of purpose and objective is bound to create doubt, divided attention and incompleteness of results. Thus, water questions are well covered in the activities of the American Water Works Association, yet the sanitary division of the civil engineers undertakes—somewhat unenergetically—to deal with water treatment on its own account. Were different phases of the subject dealt with, or were different viewpoints and personalities involved, strong argument could be made for this proceeding, but in fact the same objectives are at issue and the same men are concerned in both organizations, so that nothing but repetition can result. Similarly, structural welding receives full and authoritative consideration by the American Welding Society, which, though once mainly a promotion organization, has settled down to serious and well-balanced work. If so, shall the structural division of the civil engineers enter into welding, or is this confusing duplication? There are other examples of such needless overlap in society work, altogether suggesting that more business-like planning is in order. The confusion which results from division of activity in a specialist field can hardly be otherwise than harmful to the engineer who relies on society activities for useful and complete guidance.

Association Co-operation

THE degree to which co-operating action can correct some of the existing weaknesses in society activities depends evidently on how and for what purposes the organization is constituted. It presents a possibility of district usefulness in the work of the American Road Builders' Association. Indeed, it may be asserted that co-operative committee aid is essential if such of the association work as is directed toward unification and standardization of practices is to be most quickly fruitful. Highway building is a closely organized governmental function. This is particularly so respecting state road work and is becoming increasingly so in county and township road work. Concurrence of public roads officials is necessary to rapid promulgation and adoption of unified practices; they are organized for this purpose in the Association of State Highway Officials, co-ordinated with which is the Bureau of Public Roads. Co-operating committees of these agencies lend the committee work of the road builders' association an official visé which will vastly strengthen the regard in which it is officially held. A significant example is furnished by the work of the committee on practice in equipment purchasing, with which a co-operating committee of the state highway officials' association has joined in recommendations of approved practice. Others of the road builders' committees, as for example the committee on grading methods and equipment, can increase their influence by similar alliances, without loss of initiative or independence. Such action is more than a device for hastening specific accomplishment; it is a diplomatic move that will go far toward correcting the jealousies over prerogative that now hamper full co-ordination of association effort in the highway industry.

Honor to Constructive Genius

RALPH MODJESKI, bridge builder, who received the John Fritz medal at last week's meeting of the American Society of Civil Engineers, is the first representative of bridge engineering to be distinguished by that highest of engineering awards in the 25 years since it was established. The honor comes tardily, for

the art of bridge construction has ever been one of the noblest forms of expression of man's power over Nature, and there has been no dearth of greatness among its devotees. Yet the honor could hardly come at a more fitting time, for bridge building is fully launched upon an era of achievement reaching far beyond the greatest days of the past. Huge spans are being built over deep waters; large rivers are being crossed in spite of difficulty and cost. The most formidable water barriers are forced to yield, in order that communication between men and between separated regions of the world may be made more free. Though the bridge builder works as servant of the new demands of this traffic age, it is only by virtue of the high development of his art that these demands can be satisfied. The labors and dreams of engineers through past generations have contributed to this development. What they wrought and what their engineering and constructive genius prepared during a half-century comes to flower in the great bridge construction of the present. This new growth impresses itself upon the consciousness of all and distinguishes bridge engineering above all the other major activities in which engineers are engaged. The present award, which may spring out of that same consciousness, adds to popular approbation of the bridge engineer the homage of his fellow craftsmen. And this, as Dean Dexter Kimball most truly said, is the greatest satisfaction to which man can attain.

What Man Hath Wrought

IN DEAN KIMBALL'S address on presentation of the John Fritz medal to Ralph Modjeski there was set out a marvelous picture of what man—constructive man, the engineer—has done to reshape the world. It is a picture unrecognized or at least undervalued even by many engineers, though greatly needed by them for due understanding of their relation to other work. The speaker in simple eloquence sketched the slavery, the hopeless serfdom, in which the laboring mass of mankind was engulfed until recent times, and then pictured in contrast our present-day existence, wherein each citizen, however humble, is attended by a small company of inanimate servants whose effort not alone takes from his back the burden it would have borne in an earlier age but ministers to his needs and comforts in ways then undreamed of. As a significant feature of this development he pointed out that the wealth of the principal countries is almost precisely proportional to the amount of power which they use—the present-day measure of man's ability to produce. Proceeding, Dean Kimball reminded his hearers of that other transformation of the world, springing out of the work of municipal engineers, which gives us pure water and a clean, healthful and livable world. And lastly, drawing on a single one of the economic outgrowths of power and construction development, he pointed to the energetic campaigning against disease that is now going on and is being extended to larger scope in new medical research institutions—made possible through the labor economies created by engineering. These are elements of the broad influence of the engineering transformation on the world's social thinking and customs, which has caused two decades to create a fuller understanding of the relations of man to man and to social groups than an earlier century might have done. Engineers ordinarily, to their own loss, restrain their thoughts from entering into such self-appraising survey of their work, but unless they are conscious of these effects and changes they cannot be fully ready for their share in the future's work.

Great Bridge Construction

WORTHILY matching the award of high honor to a bridge engineer, two papers read before the society's structural division gave impressive evidence of the power of modern bridge construction as well as the high type of thought and research devoted to its major tasks. The great steel arch which is being built over the Kill van Kull, 1,650 ft. in span, was discussed by two of the leaders in its creation, O. H. Ammann and Allston Dana. Despite the boldness of the structure and the many elements of excellence in its design, even greater interest attaches to the research studies which the work occasioned. They give promise of influencing bridge construction in every dimension and type, and not only improving the art in its application to ordinary conditions but also extending its scope so that greater performances will be possible in future. It is pertinent to note that some of the chief studies were made through tests on models. Structural analysis has been highly developed, yet some questions of vital importance are difficult or impossible of solution by mathematics, but yield quickly and easily to attack by aid of models. In this case a small brass copy of the arch, investigated by load-strain methods based on the classical Maxwell reciprocal theorem to determine certain important elements of the interaction of the complex parts of the bridge, revealed facts which had not been known even approximately and which led to both economy and gain of strength. This work, together with the elaborate comparative studies of bridge types and forms, large-size failure tests of arch compression members, and investigations attendant upon the use of a high-manganese steel, contributes to bridge engineering new knowledge of remarkable value.

Reclassification of Members

THE proposal to change the classification of membership within the American Society of Civil Engineers aroused much interest at the recent annual meeting. The auditorium of the Engineering Societies Building was well filled when that subject was brought up at the close of the opening session, and judging by the showing of hands during the voting, those in attendance were about equally divided for and against, the opposition not having enough strength to have the amendment relating to the proposed classification sent out with an adverse recommendation but having enough support to get it referred back for further inquiry. Such active interest on the part of those present at the annual meeting indicates that the subject is one on which the majority of the members want more consideration given to it than it has received to date. Until shortly before the meeting few members knew that such a proposal was to be made. For that reason the check which it received at the annual meeting will serve a useful purpose. By the time the board is ready to send out its questionnaire the leaven of the discussion at the annual meeting will have spread through a large part of the membership. If so important a change is to be made it should not come about through the thoughtless marking of a ballot or signing of a petition.

Industrial Research Responsibilities

RESEARCH in industry has won a valued place during the past ten or fifteen years, and it has definite promise of even more important development in the future. What has been undertaken by great single industries and the even more influential groupings of industry, the trade associations, presents possibilities still hardly plumbed. The work to be done includes, first, development of product, byproduct and method to higher levels of quality; second, study of the uses and applications of product, and third, dissemination of the results of this work among the users so as to carry the benefit of the new knowledge to every one. It constitutes a continuing objective particularly as regards the materials of engineering, for even the most important materials are little advanced beyond the state to which they were brought by the empirical development of the past century.

These conditions give the entire profession proper reason for concerning itself in the policies of industry with respect to research and its application. The noteworthy recent change in the field of steel and cement, two of the most important engineering materials, bears on this question. How will the increased participation of the U. S. Steel Corporation in cement through purchase of the Atlas company and its merger with the Universal company affect research in cement and concrete as well as in steel? There are possibilities of large promise. The change can well lead to a broadening of the research movement in steel and increased vigor of study in the field of cement. With a wise policy of management this is almost certain.

Research is a newcomer in the field of tonnage steel production, but necessity urges it forward strongly. Present-day demands upon steel are trending rapidly away from old practices. Nearly every field of use presents a need for defined and assured quality. Specifications, heavier loads and shocks, competitive pressure for lightness, the limitless opportunities open to rustless steel, the insistent demand for higher dependability, are among the agencies which tend to sweep away the old-time hit-or-miss practices of melting and rolling steel. With but little imagination one may picture the future of the steel industry as based essentially on research. It is only a year or two since the Steel Corporation first recognized the claims of this new instrumentality; that an extensive development lies ahead is clear.

In cement and concrete, where a more determined attack has been made upon the exploration of materials and their behavior, the future is quite as strongly keyed to research as in the case of steel. Study was inaugurated a number of years ago, on an excellent plan supported by conviction and foresight. But the complexities of the problem here are such that a vast amount of future work must be done; no present limits to its extent can be discerned. Both theoretically and practically the importance of the cement problem is commensurate with that of steel, for the past quarter-century has seen concrete take its place alongside steel as a basic material of the modern construction art. Unless research in both laboratory and field application continue and grow in extent and thoroughness, concrete will find difficulty in maintaining its place.

Thus, with an equally imperative need for the development of research work in cement and steel, the consolidation of producers should lead to the establishment of a broad, re-invigorated research policy for both. At the present moment there is some room for doubt how soon this will come about. Rumor has it that the corporation's contribution to cement research is to be curtailed, nominally in respect to the application of research to practice, but actually operating to diminish the total funds available for research.

This initial step is somewhat disquieting, and creates a doubtful outlook with respect to constructive development of materials research. Nevertheless the requirements of the times are unmistakable in their call for progressive development of research and for adequate dissemination of its results in service. The call, we believe, is certain to be recognized in time and a wise general policy laid down. The engineering art as well as the using world which depends upon it will be better off for such policy.

Our Water Resources

FIVE decades ago the public domain meant to most people in the United States a vast area of either arid or mountain land, unsuitable for anything but grazing, mining and lumbering operations. One man there was to whom the public domain presented a different picture. Cognizant of what had been done for centuries by native Indians and Spanish settlers in the Far West and more recently by the Mormons in Utah, the Greeley colonists in Colorado, Sutter and his successors in California, Major J. W. Powell forcibly brought to a small but wide-awake portion of the public the irrigation possibilities of the otherwise arid West.

One of the things which he saw clearly and made a few others see the necessity of learning was not only how much additional land could be made fertile if water were brought to it but also how much water could be made available for the purpose; not much, he knew, unless heavy rains and melting snow could be stored back in the mountains. Plenty of reservoir sites existed, but streamflow records were lacking.

To meet this deficiency, the now well-known streamflow measurements of the U. S. Geological Survey, carried on as a part of its enumeration of the mineral resources of the United States, were begun just four decades ago. Ten years later, the data accumulated made possible the planning of the huge reservoirs built in the last quarter-century by the U. S. Reclamation Service. The data have also facilitated planning city water supplies, flood protection and navigation works and hydro-electric plants all over the country—for the stream gagings have been countrywide and underground water resources have been investigated as well.

The story of the inception and growth of this work, the difficulties met and overcome, is interestingly told in this issue by F. H. Newell, the man who for many years headed first the hydrographic studies, then both those and the Reclamation Service, and subsequently the latter alone. A foreword by one of his successors in charge of streamflow measurements supplements the main narrative in illuminating manner. That the work outlined has been of incalculable value to the country and should be not merely continued but greatly increased to give far better coverage than has thus far been possible is well known to hundreds of engineers and other leaders of industry, but should be still more widely and deeply appreciated by others in those classes and by the public at large.

Forty Years of Research Into Water Resources

A Review of the Problems and Vicissitudes of Building Up the Present System of Keeping Continuous and Accurate Records of the Water Resources of This Country

By F. H. Newell

Consulting Engineer, Washington, D. C.; formerly Chief Hydrographer, U. S. Geological Survey, Chief Engineer, U. S. Reclamation Service; Director, U. S. Reclamation Service

Foreword

By John C. Hoyt

Chief of the Division of Surface Water U. S. Geological Survey

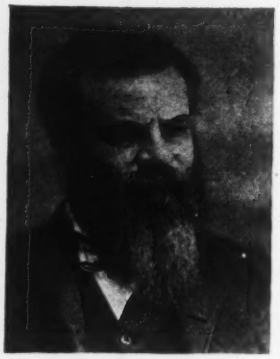
To the founder of the U. S. Geological Survey, Major John Wesley Powell, is due the credit for the conception of a systematic study of the water resources of the national domain. In his book "The Lands of the Arid Region," prepared in 1878, he points out the need of research not only in mapping the country but also in the study of the forests, soils, minerals and waters. Incidentally he includes the aborigines (he founded the Bureau of Ethnology), whose efforts demonstrated the practicability of irrigation.

Powell picked out and inspired the young mining engineer, Frederick Haynes Newell, intrusting to him the solution of the problems of water research, how to attack them and what kind of results to seek. Little was then known; unusual difficulties had to be surmounted by daring, persistence and inventive genius. Through these an engineering organization was slowly evolved and maintained at a high level of efficiency, in spite of political opposition.

Initiated originally to meet Western conditions, insistent presentation of the needs of the country was such as to bring about successive annual appropriations, beginning for the year ended June 30, 1895, in the following words: "For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells and for the preparation of reports upon the best methods of utilizing the water resources," etc.

As a natural outgrowth of this research was the act of June 17, 1902, the Newlands reclamation law. Newell assisted Senator Newlands in drafting and explaining this proposed measure. On its passage Newell was appointed chief engineer of this new Reclamation Service, continuing also as chief hydrographer, and for five years conducted both operations, those of obtaining the data of water supply and those of applying these in hydraulic construction, planning and building what were then the highest dams in the world.

By 1907 the operations of the Reclamation Service had become so vast that it was no longer considered wise to continue it as an integral part of the Geological Survey. It was detached and the Water Resources branch was organized under Marshall O. Leighton. He continued until 1913, when he was succeeded by Nathan C. Grover, under whom the research now is organized in four divisions: surface water, John C. Hoyt; groundwater, Oscar E. Meinzer; quality of water, W. D. Collins; power resources, A. H. Horton. Field work is handled from 28 district offices, each in charge of a district engineer aided by technical assistants.



MAJOR J. W. POWELL

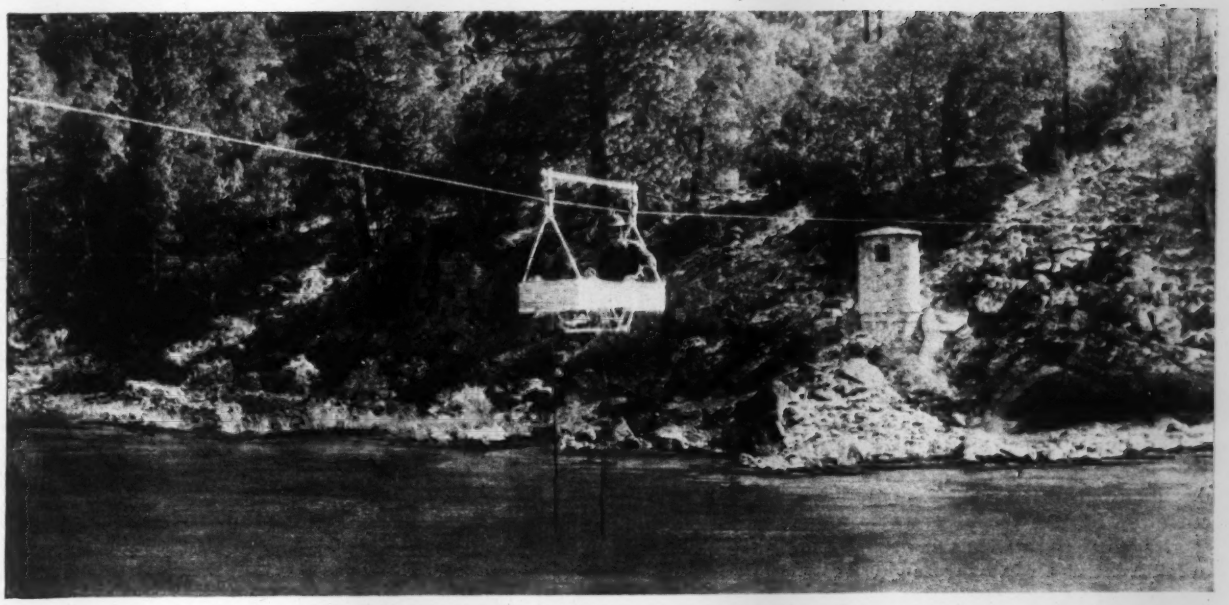
On the completion of 40 years of successful research it is pardonable to look back to the beginning of the work and ask, "How did it happen that an investigation of the water resources of this country was undertaken and how was it successfully kept growing?"

The little group of men who initiated these studies, who dreamed of the opportunities of service to the nation, have seen their dreams come true. The early struggles and discouragements, then trying, have been mellowed by time; some almost tragic then now appear humorous. Success has more than justified the self-sacrifices; the ridicule which was liberally showered upon the youthful enthusiasts who urged the importance of keeping daily records of river flow has been forgotten. A governor of one of our water power states, eloquently describing the wonderful natural resources, expressed thanks that Providence had guided someone to make the measurements on which are now being based the construction of great hydraulic works. He knew not whom, but he paid a tribute to the unknown men of vision.

Few people know how it happened. It is quite generally assumed that widespread demand existed and that some statesman in Congress, inspired by the action of bodies of scientists, took the lead. This was not the case; at that time nearly every one believed that the water and forest resources were practically limitless, that there was enough water to irrigate every acre of dry land and to furnish all needed power. Far-reaching federal activity was not generally supported by engineers nor by learned societies, certainly not by the administration. On the contrary, the proposal for study of our water resources was vigorously fought by the leading statesmen, the "watchdogs of the Treasury," who then, as now, were talking reduction of appropriations.

Those were the days long before budget officers were all powerful. Technically trained men in official circles, other than lawyers, were almost unknown in the higher positions. Little sympathy was wasted on the men of vision who predicted the future needs for exact scientific facts. The obtaining of authority and an appropriation from Congress was of necessity a personal matter, one of intense devotion, persistence and good nature; being eternally on the job, interviewing members of Congress, "lobbying and logrolling," if you please.

Major John Wesley Powell, he who lost an arm at Shiloh and later explored the Grand Canyon of the Colorado, started things and picked out the young men who



A GAGING STATION ON THE TUOLUMNE RIVER IN CALIFORNIA

were inspired to devote their lives to this self-imposed task, a missionary effort, almost a religion of public service.

Following the publication by Powell of his classic on "The Lands of the Arid Region," prepared in 1878, he persisted, in season and out, in urging upon his old army friends in Congress the necessity of a thorough study of Western resources, such as would make available the idle public lands. His constant importunities were goodnaturedly tolerated; finally authority was granted by Congress in March, 1888, to ascertain the extent to which the arid lands might be reclaimed. This was followed by a direct appropriation, on Oct. 2, 1888, small in amount, but enough to organize work in a number of localities.

First and foremost it was necessary to show immediate results in many states. Carefully conducted scientific measurements in some one locality, while they might ultimately be of greater value, would not suffice. A considerable number of members of Congress must be interested. To accomplish this, one or more important streams must be measured in each congressional district. The appropriation had to be spread very thin; many weak spots were tolerated because otherwise the work would not have received support.

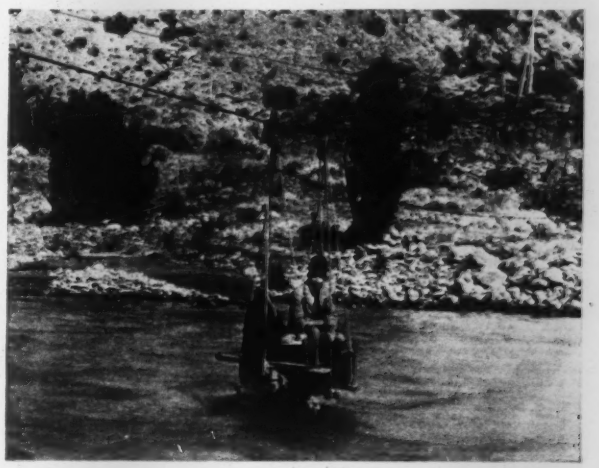
Once started, the research had its ups and downs. During one year when Congress did not appropriate for field work the hydrographer in charge secured a transfer to the Census Office and, gaining the support of friendly officials, was able to continue important river studies as part of the census work. Local chambers of commerce, presidents and chief engineers of transcontinental railroads, notably the Santa Fe, industrial organizations, each in turn were importuned for assistance; some responded liberally.

In those good old days long gone, railroad passes were a matter of course; in fact, on one transcontinental railroad the somewhat facetiously minded conductor, entering a car, would shout "Passes, please, gentlemen!" The man who paid his fare was looked upon with a little suspicion. By having a pocketful of passes, it was possible for the engineers in the field to travel at small expense and to establish river stations at widely separated points.

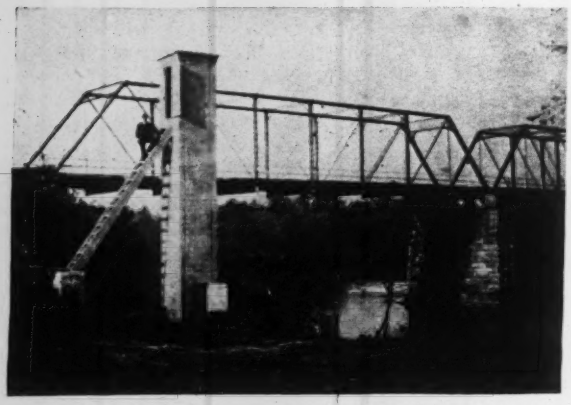
The policy was adopted of immediate publication of results, correcting in subsequent publications any errors which might be discovered. Wide publicity was sought for these and the engineer in charge was often accused of being what we now call a "publicity hound." He maintained that the public, paying for the work, was entitled to know all about it, and, more than this, to have the facts presented in the most attractive form possible.

By being eternally on the job, traveling from river to river, changing to dry clothes; seeing a governor or Congressman at his home, explaining the importance of the work to local associations, always asking for money or co-operation, it became possible to build up the annual appropriations from $12,500 to $25,000, then to $50,000, then to $75,000, and step by step to $250,000 a year, plus contributions directly or indirectly obtained. This was real work. As it expanded more and more, young men selected from various colleges were added at salaries of $60 to $75 per month, then promoted as rapidly as they demonstrated ability, or as funds permitted.

The work initiated in the arid West—that is, beyond



AN EARLY TYPE OF GAGING CAR, ARKANSAS RIVER



GAGING STATION ON THE POTOMAC RIVER IN WEST VIRGINIA, WHERE FLOOD CRESTS MAY BE HIGH

the hundredth meridian—was gradually taken up by co-operation of the Census office in more eastern states in connection with problems of drainage and of water-power development. Only a few men now living know how this was done. It was one of the secrets of the days before the rigid scrutiny of the budget. Happily, the work once established served as a precedent and was specifically authorized by Congress in 1894. It is an axiom in Washington that if you can get an appropriation three times running, you need fear little of its discontinuance.

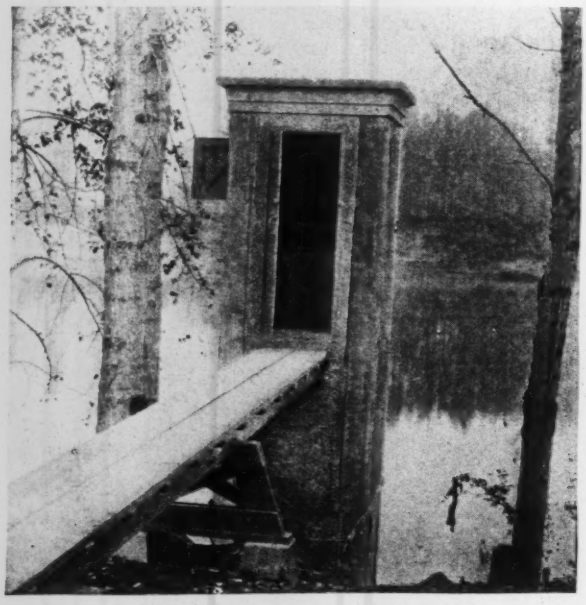
The work of measuring the quantity of water in the surface streams was supplemented by a study of the quality of this water, the amount of salt carried in solution, and also of the material carried in suspension. More than this, as the work was being conducted under the United States Geological Survey, efforts were made to find out the rate of movement underground, the quantity and quality of the waters beneath the surface.

While all this was going on, continual thought was being given to the improvement of the accuracy of the work as well as to its extension. The question was asked daily, What is the use? How can the results be so applied as to justify the expense? Having found out how much water flowed to waste during floods, it became evident that the engineers should try to determine whether this floodwater could be held, and if so, where. This in turn led to the question as to who would build the storage reservoirs, in localities where it was found that there was water and an opportunity for storage.

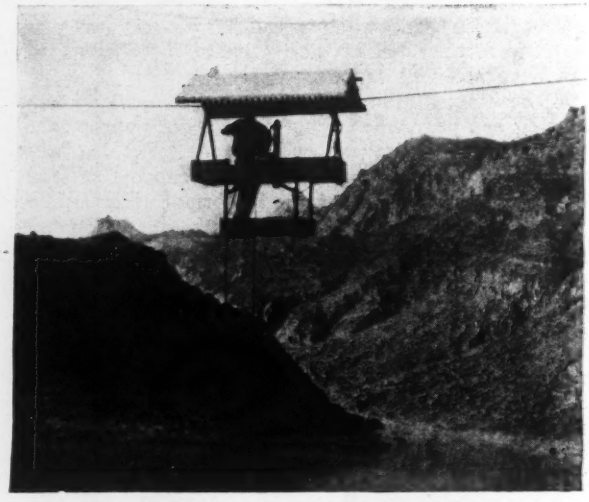
Individuals, communities and corporations, acting through the desert land act of March 3, 1877, tried flood storage for irrigation, usually with severe money losses. Then came the agitation for state efforts. The Carey act of Aug. 14, 1894, for a time seemed to offer the way out, but each state hesitated about accepting full responsibility. The slow rate of land settlement brought on bankruptcy. Of the more than 8,000,000 acres selected for irrigation under the terms of the Carey act only about a million were actually watered, much of this in Idaho. About this time came the demand that all the vacant public lands be given to the states within which they happened to be located. This was strongly opposed by the publicists who had watched the way in which the states had disposed of the swamp and overflowed lands donated to them for reclamation and who had followed the disappointments of the Carey law. Finally, after much agitation, led by Representative (later Senator) Francis G. Newlands, of Nevada, a series of bills was introduced in Congress and favorably reported upon.

Nothing happened to the Newlands bills until by a turn of fate the vigorous, enthusiastic Vice-President, Theodore Roosevelt, was pushed into the Presidential chair. One of his first official acts was to call for the men (Pinchot and Newell) who had made studies of the forests and waters of the country and to instruct them to prepare for him a draft of a portion of his first message to Congress. Out of this grew the reclamation act of June 17, 1902. It was the culmination, so far as the West was concerned, of the explorations and researches made by Powell and continued by the men he selected, aided by his successor, Walcott.

Meantime, the East was not being neglected. More and more river stations were established; and along with them there slowly grew up a larger appreciation on the part of engineers and economists of the importance of this work in connection with water-power development. The striking thing, however, is that this work has been almost a one-man or one-group affair. It has grown and developed not through broadly sustained official action



TYPICAL GAGE HOUSING ON THE KOOTENAI RIVER



MEASURING CAR AND REEL IN THE COLORADO RIVER

but in one sense almost in spite of official indifference or interference. It has been under the Department of the Interior, but of the many Secretaries who have been officially in charge of the work, few have had personal knowledge of or interest in it. They have tolerated the activity of their subordinates and have not been notably zealous in its support. The best they could do was to keep hands off.

As previously indicated, every possible effort was made to diffuse information about the work and its results. Congress grudgingly granted permission to publish the data in a series known as Water-Supply Papers, limited originally by law to 100 pages each. It thus became necessary not only to make concise statements but at the end of 100 pages to start another number. This limitation was later removed; the volume of material concisely digested and arranged for publication has now amounted to 610 separate publications, making available a great mass of valuable information.

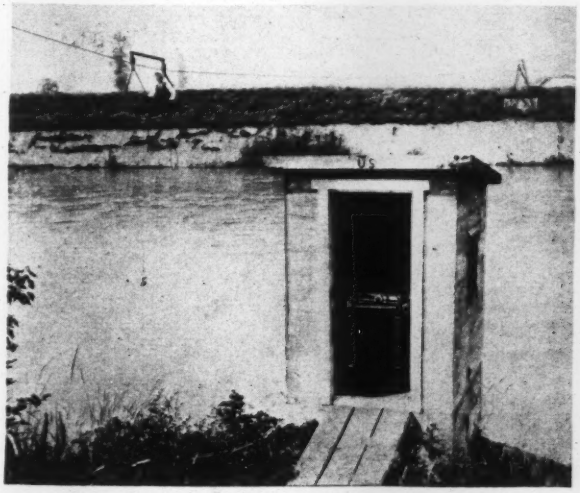
These papers, to be had originally for the asking, give the results of the studies of surface and underground waters, including their qualities and times of occurrence. It is not practicable to describe them other than to call attention to the fact that rivers in nearly every state have been systematically measured and records kept where the results will have greatest value in problems of development of hydro-electric power, irrigation, drainage, municipal and industrial supply, and other uses. The annual appropriations have not been kept up to the maximum but have averaged for the last ten years about $170,000. The total amount appropriated by Congress from 1888 to 1927 is $4,451,244. The appropriation for the fiscal year 1928 was $147,000 and for 1929 it was $197,000, plus $50,000 for special work on Colorado River. The grand total is thus $4,845,244.

This, however, is not the total amount available; 32 states have contributed, some liberally, for co-operation in this work. The aggregate to 1927 was $3,164,251. These sums, added to the federal appropriations, amount to about $8,000,000. Other governmental agencies, such as the Weather Bureau, have aided, and city engineers and engineers of corporations interested in water power have contributed data.

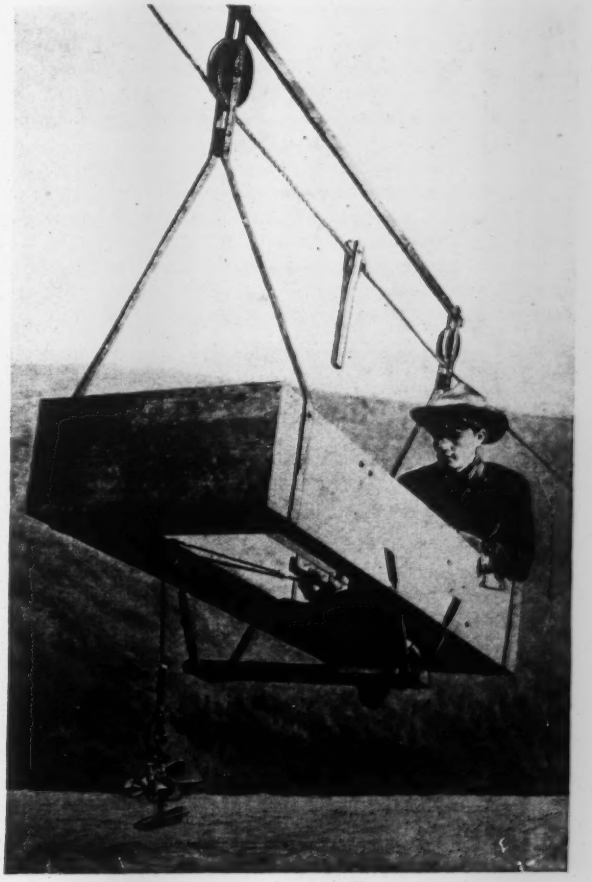
How long is this work to be kept up? This was a question frequently asked by members of Congress. The answer given was that as long as rain falls, streams flow and water is needed increasingly for irrigation, power, navigation and the supply of cities so long will it be necessary to make more and better measurements. We now recognize as never before that the growth of industry is closely tied up with the quantity and quality of available water supply. Southern California, for example, has almost reached its limit of expansion. All of the rivers have been utilized, and if growth is to continue, possibly the Colorado River must be pumped over the high mountain pass.

Even in the humid East, where water at times may be

TAKING STREAM MEASUREMENTS IN WINTER



AUTOMATIC GAGE HOUSE AND MEASURING CAR ON THE PUYALLUP RIVER IN WASHINGTON



DETAIL OF A MODERN MEASURING CAR

regarded as a nuisance, particularly in flood, we are beginning to appreciate that industries cannot continue to grow unless we can conserve the floods and utilize the water more effectively. This is quite to be expected, because all industry and life itself, man, animal or plant, is immediately dependent upon having water of the proper quantity and quality and at the right time. Deprived of water even for a short period or supplied with impure or salty fluid, life ceases.

What of the future? What have the 40 years of experience taught? First and foremost, the public has become aware of the vital importance of a reliable knowledge of the water resources of the country and of conserving these resources to the end that they may be fully utilized in human service. We have learned that while our supplies are large they are not inexhaustible. We have come to depend more and more upon carefully conducted scientific research into the details; we are demanding more accurate and therefore more expensive records.

At present the centers of operations are, in order from east to west, as follows:

Augusta, Me.	Thief River Falls, Minn.
Boston, Mass.	Madison, Wis.
Albany, N. Y.	Topeka, Kan.
Trenton, N. J.	Austin, Tex.
Charlottesville, Va.	Denver, Col.
Washington, D. C.	Idaho Falls, Idaho
Asheville, N. C.	Boise, Idaho
Tuscaloosa, Ala.	Helena, Mont.
Columbus, Ohio	Salt Lake City, Utah
Chattanooga, Tenn.	Tacoma, Wash.
Chicago, Ill.	Portland, Ore.
Rolla, Mo.	San Francisco, Calif.
Fort Smith, Ark.	Honolulu, Hawaii

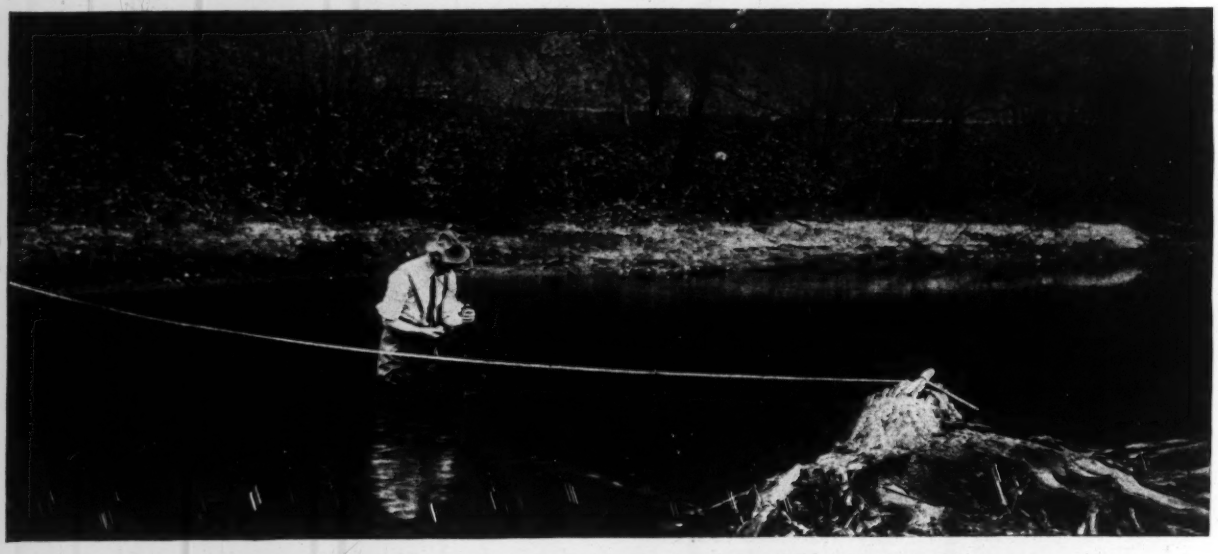
Working out from these local headquarters the engineers visit each of the thousand river stations, make frequent current meter measurements and check the gage readings. In all they have accumulated 32,000 station-years of record.

We have found that in general the communities and the states cannot or will not maintain systematic work of this kind. Even our most enthusiastic advocates of state rights are only too glad to share these duties with the federal government. We have also learned that a federal bureau once established and conducted with wisdom and economy may continue almost indefinitely if it does not get injected into politics and quietly furnishes each member of Congress with something which he can take back to his constituents to prove to them his effectiveness in working for their interests. The danger, however, is that the work may crystallize into set forms, that in order to protect the continuation of the work there will not be kept up that restless initiative and reaching out after new facts and new applications such as characterized the work of the earlier generation.

Perhaps it might be fairer to indicate that this reaching out should really be done by state organizations; that is to say, if the federal bureau can and will continue indefinitely to obtain certain fundamental data, it should be the duty of the state not merely to co-operate in furnishing them but more than that, to make local application of the facts thus made available. The federal bureau may thus lay the foundation on which the superstructure should be erected by state officials.

It would hardly be proper for a federal employee to take up one state after another and describe in glowing terms the opportunities for larger development and use of the water resources. Invidious comparisons might be claimed and sooner or later some member of Congress would bring the charge of favoritism. It is possible, however, for the appropriate officials of a state to take these fundamental facts, show to their own satisfaction at least that their state had certain advantages and that it is possible to utilize the water resources in building up the hydro-electric or steam-electric plants and to bring in the many industries which can find local supplies of raw materials. It should be the duty of each state to promote its own development by planning for the most complete use of its waters. Each should present the most attractive picture possible of the results which will come from carrying out such a plan.

It is not to be supposed that any such plan of complete utilization can or will be adopted in its entirety, but as new schemes are proposed from time to time, it will be possible to determine the merit of them by contrasting each with the ideal. Under such a plan state officials will be in a position to aid or guide investors and others and, with a clear vision of the possibilities of sound development, can do their part toward realizing the great opportunities for prosperity based on the rational utilization of surface and underground waters.



MEASUREMENTS OF SHALLOW STREAMS ARE TAKEN BY WADING

Progress in Highway Thinking and Planning Reviewed at A.R.B.A. Convention

General and Divisional Sessions Dispose of Seventeen General Committee Reports on Financing, Design, Construction and Upkeep of Roads and Streets—Notable Separate Reports on Grade Crossings and Regional Planning

Engineering News-Record Staff Report

TECHNICAL discussion of highway problems at the Atlantic City convention last week of the American Road Builders' Association was confined largely to the formal reports of committees. This reflects the new setup of association activities by which committee work and surveys by staff employees, carried on through the year and summarized in annual reports, have taken the place of individual papers in the convention proceedings. With seventeen committees, some of which presented half a dozen sub-committee reports, the volume of written matter presented for consideration was formidable and allows only a brief epitome of the outstanding reports.

Briefly, the divisional organization of the association was followed in arranging the sessions; there were at times three divisions in session simultaneously. In the summary of proceedings which follows, chief space is given to the committee reports having broad general interest and less space to the reports of local or restricted interest. In general, attendance at the sessions was small and the discussion was meager.

General Reports

Grade Crossings—Presuming that the number of grade crossings makes it necessary that every economy be sought in design and construction, the committee points out that between an overhead crossing and an underpass, the choice depends upon topographic and other conditions at the location. It is generally more economical to use an overhead crossing, since the underpass must be designed for heavy railroad loads and the construction is more expensive because temporary structures must be provided to carry the traffic while the permanent structure is being built. This report deals with overhead crossings.

An overhead crossing consists of the main structure over the railroad tracks and an approach at each end. Each crossing must be studied as a special case. However, the principal features of the structure over the tracks may be standardized to a certain extent and this report provides standard designs, Figs. 1 to 3, which, with some modification for each particular case, may be used at most locations.

The main structure may be constructed of concrete, steel, wood, or combinations of these materials. The usual practice is to use simply-supported superstructures delivering a vertical reaction to the substructure, because of the ease with which the stresses may be computed. In continuous structures or rigid frames the design is more difficult, but a considerable saving in cost is possible.

In using rigid-frame structures it is important that reasonably unyielding foundations be assured, as settlement is more injurious to this type of structure than to the simply supported type. The following allowable pressures are recommended for foundations in different kinds of soils:

	Safe Bearing Power, Tons Per Sq.Ft. Min.	Max.
Alluvial soils	½	1
Clays	1	4
Sand, confined	1	4
Gravel	2	4
Cemented sand and gravel	5	10
Rock	5	Indefinite

In simply-supported spans, the abutments must be designed to be self-supporting without aid from the superstructure for withstanding the earth pressure from the fill. In the rigid-frame designs the abutments may be considered as supported at the foundations and at the top by the superstructure, thereby greatly reducing the amount of material required for the abutments.

The report gives a digest of specification requirements for materials and construction and compares on an assumed price basis the costs of the types of structures illustrated. The comparative total costs, including 10 per cent for incidentals, are as follows:

Type Structures	One Track	Two Track
Timber	$4,469	$6,841
Steel	8,073	8,845
Concrete	10,206	11,052

As an indication of the relative economy, it is pointed

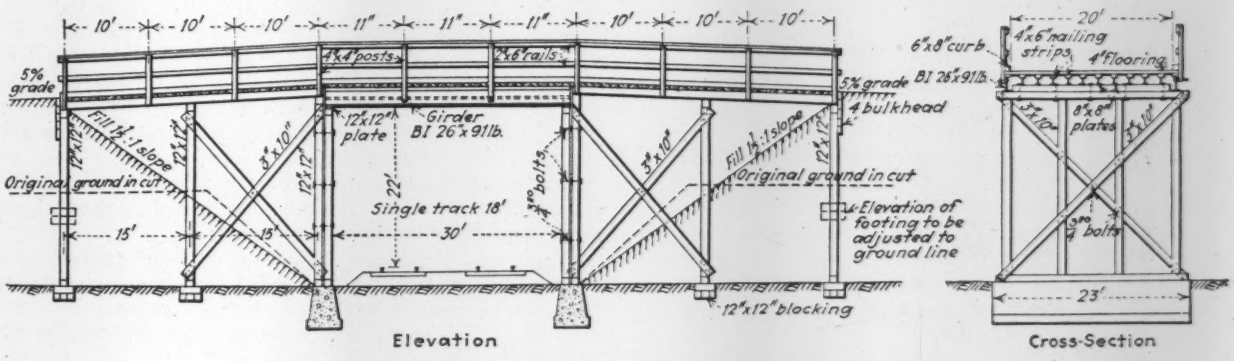


FIG. 1—TIMBER STRUCTURE OVER DOUBLE TRACK

out that a concrete structure, designed as simply supported spans on the usual type of piers and on abutments with wing walls, would require approximately 30 per cent more concrete and reinforcing steel and cost about 25 per cent more than the rigid-frame type.

Methods for Purchasing Equipment—This committee report, concurred in by a co-operating committee of the Association of State Highway Officials, gives first a summary of facts secured through questionnaires regarding state laws governing equipment purchase and also a summary of data pertaining to methods of equipment purchase. Second, it includes recommendations of the states as indicated in the summary of the questionnaire.

It is recommended that all purchases of equipment over $500 be by formal lettings, purchases from $50 to $500 be by informal lettings and purchases not to exceed $50 be by private negotiation.

It is recommended that there be an exchange and comparison of experience and information on service and cost records and purchase price of different kinds and makes of equipment and that a central agency be established for the exchange of this information; that in purchasing equipment no trade-ins enter into the transaction; that purchase of county equipment be handled by clearing through state highway departments when so requested by the counties, and that model specifications, inventory, equipment service and cost record forms be prepared.

When purchasing equipment it is recommended that in awarding contracts the determining factors shall be considered in the following order of importance: (1) your own past experience with similar machines; (2) performance record of equipment; (3) experience of others with similar machines; (4) efficiency in repair parts service; (5) mechanical details of equipment; (6) first cost of equipment; (7) materials used in equipment; (8) price of repair parts; (9) length of time products have been on market; (10) financial standing; (11) past performance of bidder; (12) capacity of plant and ability to make prompt deliveries; (13) number of similar machines manufactured and sold.

Grading Methods and Equipment—The work of the committee in 1929 has been confined largely to a practical survey of grading practice in respect to classification of roadway excavation, embankment construction, classification and methods of payment for excavation for structures, classification and methods of payment for borrow, disposal of surplus excavation and payment for and procedure in respect to overhaul. Through the staff of the association under the direction of C. N. Conner a digest was prepared of the requirements in all state highway specifications covering these six subjects, and the results were tabulated for easy comparison. The outstanding fact brought out in this survey was that wide variation in practice prevailed and that in instances this lack of uniformity had no logical reason that was apparent.

Considering the variation in requirements, the committee, while premising that some differences of practice could be allowed states having widely different soils and topography, puts these queries:

Why should one state require solid rock excavation to be made 6 in. below the subgrade, another 8 in., another 10 in., another 12 in., and still another 24 in.? To be sure, various depths might be required because of frost action, but the difference between states is not based upon any such distinction, as for instance Louisiana calls for 12 in. while Maine specifies but 4 in. Certainly the pavement construction is practically the same no matter what the geographical location in this respect. For another instance one state provides a free-haul limit of

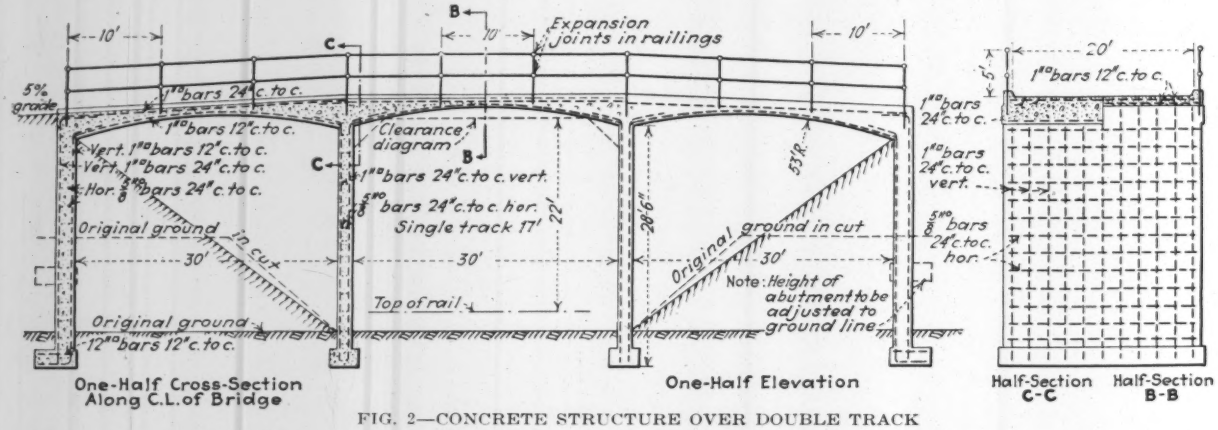


FIG. 2—CONCRETE STRUCTURE OVER DOUBLE TRACK

300 ft., another of 500 ft., a third of 1,000 ft., a fourth of 2,000 ft. and still another 5,000 ft. Obviously these cannot all be justified by variations of conditions but rather have become established because some engineer back in the beginning of road construction chanced to select a particular figure. In the method of placing embankments, certain states permit types of equipment which are prohibited in others. Some states require embankments to be placed in layers 8 in. in depth, others 1 ft. and others 2 ft. These specifications undoubtedly have come into being in the same way as the overhaul variations. With regard to equipment, we find again a large variation, different states requiring different types and weights of rollers, some insisting that fills be puddled, others being of the opinion that such methods are unnecessary, while still others insist upon jetting and sprinkling or have a requirement for rolling with various special designs of roller wheels.

Basing its findings on this situation, the committee believes that work should be directed toward securing more uniform practice and so far as possible toward some degree of standardization. It therefore plans to increase its membership in number and geographical representation and undertake by group conferences to secure agreement on uniform requirements.

Highway Financing—This committee of twelve engineers, bankers and highway officials presented statistics on present sources and distribution of income and on the present use of funds in construction and maintenance in both state and counties. Commenting on these facts, the report states that the shifting of the tax burden from

levies on real estate and other sources to the user of the highway is a constructive step. It should continue to a point where general taxation for highway purposes is reduced to a minimum. With a steady increase in revenues derived from automobile taxes assured and additional funds derived from increased federal appropriations probable, these sources should eventually account for the greater percentage of financing on state and county highways.

Use of county funds for state highway construction is the practice in many states and accounts for a large percentage of the expenditure in these states. The financing of state highways with county funds, however, is not recommended and should diminish with the increase in revenue from other sources.

Recent bond issues have been predicated on the gas tax. This has proved sound financing, and inasmuch as returns are steadily increasing and funds available may be readily estimated over a period of years, amortization charges, maturity dates and annual expenditures can be forecast with a reasonable degree of accuracy.

The allocation of a percentage of state gas tax funds to counties is becoming increasingly popular, and at the present time 41 states are sharing receipts with counties. That rural highways are in need of funds for improvement in every state is unquestionable. Yet the use of state funds for rural highways before the state system is in a fair degree of completion is not particularly recommended. The through highways accommodate the greater percentage of traffic, probably 90 per cent, and these are the backbone of the county's highway system. The rural highways are the feeders loading into this system, which is the obligation of the state and federal governments and therefore state and federal funds should be used exclusively on the trunk-line system at least until impassability has been eliminated.

Unquestionably here is a large highway mileage included in the country's local system which has little economic value. In the President's recent message to Congress this factor was mentioned with the suggestion that uneconomic mileage should be abandoned and turned back into some useful purpose. The total mileage of local roads existing at the end of 1928 amounted to 2,709,839. That a percentage of this could be eliminated by relocation is obvious. Also it is evident that this reduction is necessary as an economic step in the development of the rural highway system.

Regional Surveys and Plans—A compendious résumé of all that has been done in regional planning was given in this report by L. C. Smith and E. A. Griffith, of the Wayne County and Allegheny County highway departments, with Stanley Abel, supervisor of Kern County, California, as general committee chairman. Barely a synopsis is all that can be given of this outstanding survey of practice.

In all, 36 regional areas in seventeen states were studied and the information was assembled under the following headings: (1) type and size of regional areas; (2) legal basis for regional planning; (3) phases of planning handled by regional organization; (4) operating methods; (5) financing of the operating organization; (6) extent to which regional organizations average in detailed surveys, plans and preparation of development programs; (7) administration of programs and methods used to carry out plan recommendations; (8) planning accomplishments in regional areas; (9) significant trends in regional work; (10) recommended regional organization, including size of area, type of organization, operating methods, financing and phase of planning work.

Commenting on the financing of regional improvements, the committee says: The financing of planned improvements should be based, in general, upon the benefit theory of taxation. General revenues of counties and municipalities can be used to provide the share assignable to general social benefit; the gasoline tax is the most equitable source of the share assignable to benefits to traffic; and special property assessment should be used to provide the share assignable to benefited property. Although the benefits accruing to each of these beneficiaries will vary with individual improvements, all improvements of regional importance should be financed through contributions from each of these three sources.

The common practice of limiting state and federal participation in highway financing to rural regions results in placing an unfair burden upon sources of income in cities and regional areas. State highway systems should be extended into cities to serve state traffic operating into and through these areas. Such extensions should involve the participation of the state in the financing of major highway improvements within these regional areas. A trend in this direction is seen in the increasing demand of cities and municipalities for a share of gasoline tax revenues based upon the amount of such revenues produced in these areas.

Gasoline tax revenues should, in general, be used for the development of important traffic routes in both regional and rural areas. In regional areas these routes are the major arterial routes into the city. The gasoline tax revenues equitably assignable to regional areas, whether allotted to the state or to municipalities, should be used for the development of these routes.

Satisfactory execution of a regional highway plan requires regular annual revenue for a period of several

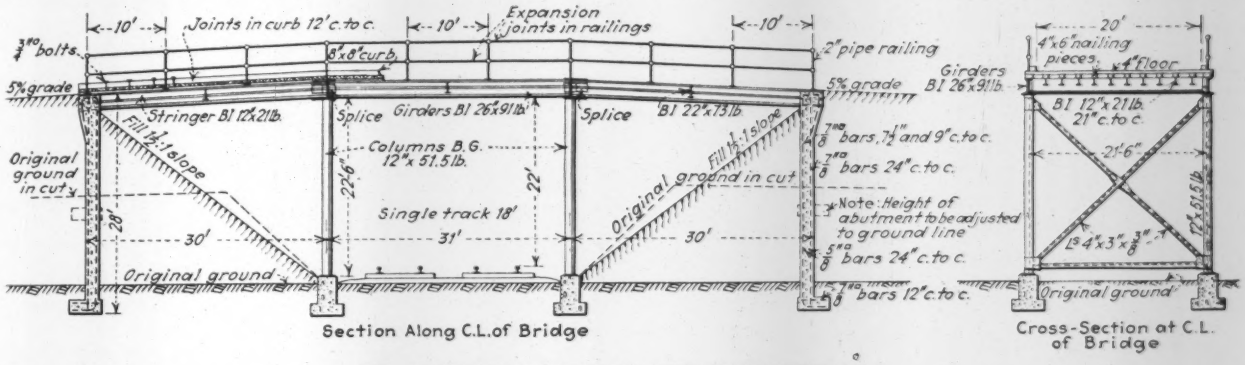


FIG. 3—STEEL STRUCTURE OVER DOUBLE TRACK

years. Since highway development is a continuing program, revenues should be produced largely from current income rather than from the use of credit. Bonds are justified in the case of major structures and other unusual projects.

County Engineering Division

A notable series of reports was presented by the four general committees of the county engineering division. An appraisal of the committee report on regional surveys and plans has been given. Equally extensive reports were made on design and construction, on maintenance, and on legislation, finance and administration.

Legislation—The report calls for a non-partisan board of road commissioners, a competent county engineer, authority to enforce road restriction laws, taking over township roads as traffic grows, restriction or diversion of motor-vehicle funds to municipalities, and state cooperation. In respect to federal aid, pronouncement is made that it should not extend to secondary or tributary roads. Any road important enough to receive federal aid should be in the primary system. To carry federal aid much beyond the present 7 per cent system would mean spreading it so thin that no practical benefits could result.

Finance—A survey of the relations existing between states and counties in highway transactions reveals that in most states the state has taken over about 10 per cent of the total mileage for the purpose of maintenance, and in many the state has also assumed the burden of construction costs. This situation should be clarified by providing separate sources of revenue for the two general classes of roads—state and local—with avoidance of interchange of funds and credits. Provision should also be made for the annual transfer to state jurisdiction of fixed mileage of improved local roads for maintenance purposes, leaving to the county the task of developing farm-to-market and feeder roads which at present do not carry sufficient traffic to warrant construction of the types utilized in state systems.

Location—Discussing separately the various problems of curvature, gradient, right-of-way, etc., the report states that the stage or progressive method of construction should be used in the development of a county road system; that the location, grading and drainage of the road are the permanent portions of the improvement and the first steps in the stage construction development; that for ultimate economy the location must be considered as a unit in a comprehensive system of county road improvement, and that the relative importance of the road and the nature of the design should be based upon a thoroughgoing economic and traffic survey of the entire county.

Untreated Surfaces—Considering surfaces for traffic not to exceed 500 vehicles per day, the report concludes that untreated surfaces may be considered as the second step in the stage or progressive improvement of a road surface, and that the subgrades of untreated low-cost surfaces must be thoroughly drained in order to preserve them from disintegration under traffic when the climatic conditions are unfavorable.

Treated Surfaces—Broad conclusions indicate that bituminous surface treatments are preferred over bituminous dust layers because they have a higher residual value for continuous maintenance or stage-construction purposes, and better riding qualities; that practice varies, but as a rule tar is preferred to asphalt as a prime coat because it penetrates the sub-base more deeply, does not "ball" to as great a degree as asphalt when in contact with dust and dries more rapidly, thereby offering less inconvenience to traffic, and that asphalt is generally preferred for the seal coat because of the slowness of the evaporation of its lighter oil constituents, which make it retain, longer than tar, its cohesive properties for stone aggregates and waterproofing ability over the cracks in the prime coat.

Pavements—Certain outstanding requirements may be discerned as follows: Pavement surfaces must be built increasingly smoother to provide for greater safety and comfort of travel and to reduce the adverse effect of the impact of truck wheels upon the surface; smoother surfaces may be obtained more easily by mechanical than by hand methods; mechanical equipment must be increasingly used so as to speed up construction operations and thereby increase the general rate of road improvement, and pavements must be wider or the adjacent shoulders more carefully built, so as to avoid the danger of an exposed pavement edge to fast-moving traffic.

Maintenance—Seven sub-committees covered the following subjects: shoulders and drains, untreated surfaces, surface treatments, pavements, equipment, snow removal, and signs and guard rail. Among the general conclusions were there: Shoulders and slopes may be beautified at less cost than continual maintenance; a treated surface of not less than 18 ft. is recommended; high-early-strength concrete is recommended for patching; the trend in tractors is to more power, and it is not economical to use trucks as tractors.

Highway Contractors' Division

The two sessions in the highway contractors' division brought out eleven papers and reports, including excellent discussions of prequalification of contractors, contracting in foreign countries, airport construction and credit reform and two exceptional reports on liens in public construction and on bonus and penalty practice and weather conditions and working time in 48 states.

Public Works Liens—The committee making a study of liens in public works construction reported the completion of its work by an abstract of all state laws and their review by Dan H. Wheeler, secretary, standard mechanics lien act committee, Department of Commerce. With the text of the committee report presented in 1929, the full report makes a document of 390 pages, which will be printed.

Weather Conditions and Working Days—Weather conditions as they affect the number of working days and indirectly the action of penalty and bonus clauses were set forth in this survey by C. N. Conner, engineer executive, and P. F. Seward, assistant engineer, American Road Builders' Association. It was found that in all but four states the dates of completion of contracts are set by the highway department engineers. A table of weather conditions has been worked out for various sections of all states, giving working days for grading and paving, mean annual precipitation, mean high and low temperature and mean fall and spring frost dates. This table has been printed and is available.

The survey shows that all states inflict upon the contractor a penalty for failure to complete work on time. It is variable in form but the one common penalty is to charge the contractor with the additional cost of engineering required by his failure to complete the work within the specified time. Other forms of penalty include a specified sum incorporated in the contract as liquidated damages. Of the 48 states, only nine specify a bonus for the completion of work ahead of time.

Steel Frames for Houses

Three Articles Analyzing the Problem and Proposing a Course of Procedure That Will Modernize the House-Building Field

By T. J. Foster
Chairman, National Bridge Works, Long Island City, N. Y.

II—Analysis of Requirements

Unit fabrication in the shop is feasible if mass production methods can be utilized and the large available market aroused to possibilities. Standardized elements of construction do not mean standardized homes.

In the first article, published last week, Mr. Foster, after pointing out the widespread inefficiency in the field of residence construction and the shoddy structures that often result, reviewed the scattered efforts of various individuals and firms to accomplish radical improvement by use of steel framing. No one of these pioneer steel residences elicited any strong following, and we are today little advanced over twenty years ago in applying steel to residence construction. In this article Mr. Foster presents the thesis that one of the great troubles has been a lack of marketing foresight and of proper promotion methods. He also advocates unit fabrication in the shop and nation-wide selling. —Editor.

OUR POPULATION of 120,000,000 requires approximately 24,000,000 homes. The annual increase is 1,500,000, which requires an additional 300,000 new homes. Houses are destroyed by fire, by replacement with other buildings and by obsolescence. If we estimate the average life of a building as 50 years, then we must replace 2 per cent of the homes each year, or 480,000. Adding this to the 300,000 for the new families makes a total of 780,000 homes to be built each year. At the average cost of $4,190 per family, as given by *American Builder* for dwellings in 49 cities for the first six months of 1928, this would represent an annual outlay of $3,268,000,000. And this estimate is probably low, since the better class of housing is nearly all in the small towns, outside of the cities considered in this survey.

An important opinion on future building conditions was recently given by Magnus W. Alexander, president of the National Industrial Conference Board. Speaking before the New York Building Congress, Jan. 24, 1929, Mr. Alexander said:

> The trend of construction shows no indication of any serious decline; indeed, our rapidly changing standards of housing both for residential and for commercial uses would seem to indicate an entire rebuilding of large sections in most of our cities within the next decade or two at a rate faster than normal population increase would call for. Costs, however, must be kept down and reduced wherever possible. Further mechanization, engineering research and ingenuity and such increase in speed as is in accord with sound construction principles appear to me the chief means by which this end may be achieved.

Better Business Methods Needed

Providing homes for contentment, comfort and happiness is not a problem of philanthropy. It is a better business proposition than the automobile, the radio or the telephone, the combined production value of which is less than that of house construction alone. But the building industry will require national organizations that can afford to employ the best artists, engineers and builders; that will train men in new methods; that will send materials to the building ready to fasten into place; that will be responsible for the materials that go into the houses, and for their installation; that will fit each house to its environment; and that will establish enlightened methods of financing.

Difficult as this may appear, it is probably a simpler proposition than designing, building and merchandising automobiles. It may require $5,000 to design a small house properly, to make all the necessary drawings, to compile bills of materials and to pay general expenses before it can be built. But the details, once determined, can be used thousands of times, thus making the cost negligible for each structure.

Such standardization does not mean a loss of individuality for the home. With proper proportions and well-designed details, the basis for an attractive house is assured. The finishing touches are what transform a house into a home. There is a certain amount of hand-

FIG. 1—STEEL-FRAME STANDARDIZATION IS NOT STANDARDIZED ARCHITECTURE
Three steel-frame houses built by the McKay Fireproof Company in Cleveland.

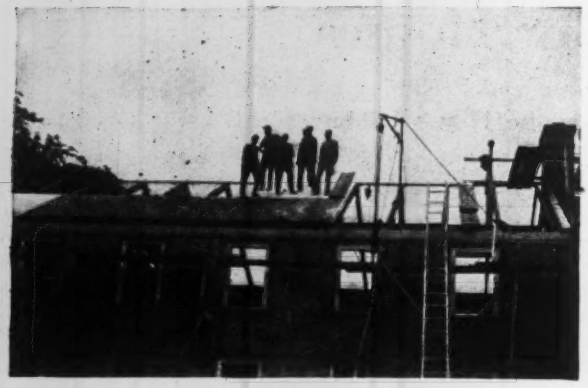


FIG. 4—PLACING JOB-FABRICATED GYPSUM SLABS FOR A BUILDING ROOF

attic house, these columns would be made in one piece. The first-floor steel would then be set, followed by the precast slabs, if they are to be used. The second floor, attic floor and roof will follow in sequence. The partition slabs can then be hoisted to their respective floors and the wall slabs to their positions. This prepares the floor for the felt and finished flooring, the roof for the roofing felt and finished roof, and the exterior of the house for brick, stucco or any desired finish, and the interior for the trim and final decoration.

The plumbing, the heating and the electric wiring can easily be taken care of when using this type of construction, but the details are not necessary to the general explanation.

Some Suggested Details

The first construction in which I used a sound-deadening material with a thin, low-cost concrete slab was installed in a house at Great Neck, L. I., in which Jones & Laughlin junior beams on 2-ft. spans were used, with a $\frac{3}{8}$-in. plasterboard stiffened with wood mailing strips and a 2-in. chicken wire mesh. Fig. 2 illustrates this method except that in the illustration the reinforcement is a heavy wire, which, incidentally, accommodates a 4-ft. span as cheaply as chicken wire does a 2-ft. span. A flat ceiling was placed beneath the beams. While this gave a non-combustible construction that was soundproof and vermin-proof, it could not compete with wood construction on a price basis. The roof of this particular residence was made of precast gypsum slabs on rafters spaced 2 ft. on centers. The erection of these blocks was held to be the mason's job, and this made the roof too expensive.

The first floor for which I used a plasterboard reinforced with wood strips and resting on steel channels 4 ft. apart, much as shown in Fig. 2, was in the post office at Easthampton, N. Y., which was erected in July, 1927. The total thickness from ceiling to finished floor was 3 in. The beams were exposed in the ceiling and the plasterboard and beams painted, giving a room similar in appearance to the one shown in Fig. 3.

The roof of this post office building (Fig. 4) consisted of 30-lb. aërated gypsum slabs made at the building site and dried in a temporary shed. Fig. 5 shows three steps in the manufacture of these slabs. Standard beams were used instead of light joists because they are more rigid, have wider flanges and permit wider spans and therefore reduce the number of pieces to be handled during erection. Furthermore, loads can be placed on these beams during erection with greater safety than on the lighter joists.

This construction does not come under the fireproof classifications, because the beams are exposed, but these can be fireproofed economically by casing them and showing a beam ceiling modeled somewhat after the design shown in Fig. 2. In any event, the use of plasterboard slabs and the resulting thin floor permits higher ceilings to be used than with present construction; also, if higher ceilings are not desired, the use of thin floors permits of a reduction in the total height of the house. Another construction is illustrated in Fig. 6. This is known as a "floated floor," and recent experiments indicate that it is more effective as insulation against transmission of impact noises than is a hung ceiling.

Fire tests have been made on the slab shown in Fig. 2 with the following results:

1. In testing a cinder concrete slab $1\frac{3}{4}$ in. thick with $1\frac{3}{4}$-in. sleepers, untreated, and with an average temperature of 1,400 deg., the wood top flooring was burning in one hour.

2. On the same floor, but with $2\frac{1}{4}$ in. of cinder concrete, the wood top flooring was burning in two hours.

3. On the same floor with $1\frac{3}{4}$-in. cinder concrete but with treated sleepers and with a temperature of 1,400 deg., it was two hours before the wood top flooring ignited.

In the fireproofing specifications, 10 lb. of material per square foot of floor is assumed to be necessary to provide a 1,700 deg. fire for one hour. Mr. Statler, of the Statler Hotels Corporation, found that with rugs, carpets, wood trim and furniture, the weight of combustible materials in an ordinary room was less than 10 lb. per square foot. If steel trim were substituted for wood, it would take an exceptional fire to harm joists that are capable of bearing 1,000 deg. of heat without failure.

Load tests made by Columbia University for the bureau of buildings of New York City have indicated that a cinder concrete slab, made in accordance with the details

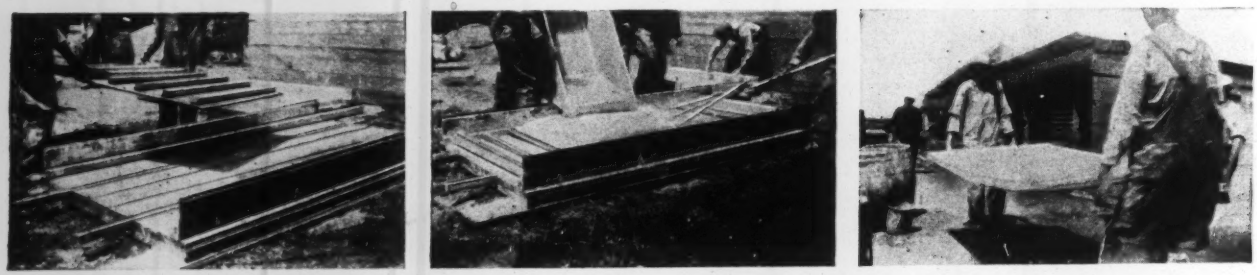


FIG. 5—MANUFACTURING GYPSUM ROOF SLABS ON THE JOB
Left: placing form which becomes integral part of slab. Center: pouring and screeding the aerated gypsum. Right: removing green slab to drying shed.

work in the construction of the chimney, in placing the exterior brick, stone, stucco, etc. Entrance doors and windows can be distinctive. Different sides of the structures may be placed toward the street. Variations in color schemes, in environment and in landscaping will change the character of a house. It would be as correct to expect every man to look the same because each has the same set of bones in the same relative positions as to imagine that every house would look the same because it had the same skeleton frame. A house that is well proportioned, with its structural lines forming a basis for artistic treatment, gives every opportunity to express individuality and attain artistic merit.

Essentials of Structure

A study of the character of materials available in the market suggests to the writer the use of the following for house construction: a steel frame, strong and rigid enough to take all stresses; inclosures, partitions and floor filling of cementitious material that would take only local stresses and transfer them to the frame; enough wood or similar material for fastening floor and trim sufficiently embedded to prevent damage from expansion, contraction or fire; an exterior material of mineral origin properly waterproofed; and insulated walls, partitions and floors—the walls insulated for both heat and sound, and the partitions and floors for sound and for fire protection. Such a construction would guarantee structural security, safety from fire, economy of upkeep, absence from vermin and comfort in winter and summer.

Steel buildings are detailed and fabricated to such exactness that it is seldom necessary at the building site to make a hole or cut a single piece. Practically all of the house, the plumbing, heating, electric work, trim, partitions, etc., as well as the frame, may be fabricated

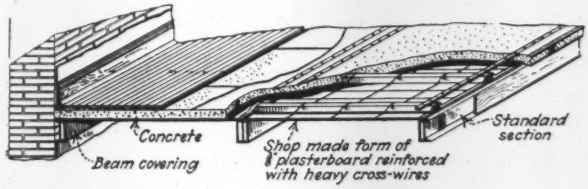


FIG. 2—THIN SOUNDPROOF FLOOR, NATIONAL BRIDGE WORKS

Plasterboard form rests on top of standard beam sections, spaced 4 ft. apart. Exposed beam ceiling, illustrated, can be converted to flat ceiling by attaching ⅜-in. plasterboard beneath beams.

in a similar manner. The entire time of the men on the job could then be consumed in putting the pieces in place.

Furthermore, it is possible to build a small, economical residence of non-combustible materials without developing any new materials or rolling any new sections. A steel frame can be designed to use the same columns, girders and beams as are at present used in large steel-frame buildings. Columns could be placed as far apart as the width of a room, and in the writer's opinion this is the proper method of approach to the steel-frame house problem. Beams on a span of 4 ft. would give as economical a floor slab as a shorter span, and with such a span ordinary sections could be used, thus eliminating any necessity for rolling light steel members. Sufficient stiffness at girder and column joints can be obtained economically, especially with the use of welding.

The basement walls could be precast reinforced-concrete slabs of sufficient thickness to resist the earth pressure. These slabs can be made and erected as cheaply as forms can be placed for pouring walls; and by waterproofing the slabs a better basement wall can be developed than is now generally used.

So far as floors are concerned, there is every reason from an artistic and practical standpoint for making the body of the floor serve also as the ceiling. Indeed, this is now done in apartment houses quite generally, where beam ceilings have proved artistic and economically superior.

It is of great importance to make the floor as thin as possible. This will assist in the artistic treatment of the house by keeping the height of the building low in proportion to its width. For instance, if the floor thickness is 3 in. instead of 13 in., the saving in height is 10 in.

FIG. 3—BEAM AND PLASTERBOARD CEILING IN LONG ISLAND CITY OFFICE OF NATIONAL BRIDGE WORKS

Similar to design shown in Fig. 2.

per story. In a building of three stories this difference is valuable from a practical as well as from an artistic point of view.

Floor slabs for small houses can be made either by precasting or by pouring at the building site. In either case the bottom of the slab can be finished with a surface that needs no plaster and that is sound absorbent. These slabs can be supported either by resting them on the top flange of the beams or on the inclosure of the beams when they are fireproofed.

When precast slabs are used, aërated gypsum is preferable as a filler between the slabs. A precast slab 4 ft. wide and 8 ft. long can be easily handled and will not weigh more than 170 lb. Also, the thickness from the finished floor to the ceiling under it will not be more than 3¼ in.

Wall and partition slabs can be precast, with their exposed surface made of sound-absorbent material. A convenient size for handling is 4 ft. wide by the height of the room. Such slabs can be fastened top and bottom and joined together at two points in their height. They are amply strong, light enough for two men to handle and can be quickly installed.

Erection—Floorbeams of a size sufficient to carry 4-ft. spans are too heavy to set by hand above the first floor, and a light derrick will be necessary. This may be furnished on an auto truck for convenience. The derrick then becomes useful not only for the steel frame but for setting all the heavy construction of the building.

The erection of the building starts by setting the columns on the basement footings. For a two-story-and-

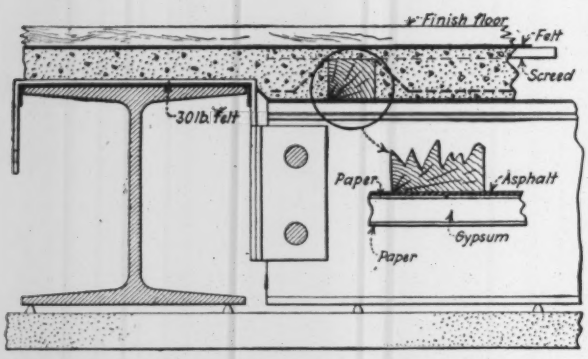


FIG. 6 — "FLOATED" FLOOR OF SOUND-DEADENING DESIGN
Advantages claimed are isolation of sound from steel, harmless expansion in case of fire and a minimum of dead-wall space.

shown in Fig. 2 (and 4 ft. wide), will carry an ultimate load of 300 lb. per square foot with $1\frac{3}{4}$ in. of concrete and 540 lb. per square foot with $2\frac{3}{4}$ in. of concrete. One-sixth of the ultimate load is allowed in New York City.

This above description of the writer's conception of the modern house and of some of the structures which he has built again emphasizes the fact that the entire strength of the structure is in the steel skeleton and that the floors, roof, walls and partitions are only divisions in the building that give the greatest possible protection from heat and sound at the minimum price. With the steel frame made to exact dimensions, the wall, partition and floor slabs cast to exact sizes, the heating and plumbing fabricated before delivery, an entire building can be erected, ready for the exterior finish, by using a screwdriver, a hammer, a wrench and a derrick.

There are many problems to be solved before we can properly build a small house. Beauty, convenience, comfort, economy and stability must head the specifications. Engineering skill, superior materials and sound financing must carry them out.

If we are to solve the small house problem, we must not tend toward any single building material such as concrete, steel, gypsum or brick. We must analyze each portion of a building in the light of all material available before choosing, and try to use the best material for each part.

Many suggestions will be offered for the solution of the small house problem. Weaving them together will finally show how well the design was made. The present methods of production were explained in the first of these articles; an analysis of the needs and of materials has been given in this one. The subject would be incomplete unless there were shown the possibilities of changing the methods to suit the needs. In the third and concluding article a program will be laid down which, if followed, should go far to improve residence construction the country over.

Heaviest Welded Truss Erected in Glendale, Calif.

Loads Up to 1,000,000 Lb. in Mausoleum Framework Transmitted by Slot Welds in Gussets Designed for 14,000 Lb. Per Linear Inch of Weld

By H. J. Wallace
Chief Engineer, Forest Lawn Memorial Park Association, Glendale, Calif.

THE heaviest steel truss yet welded, 96 ft. long, 17 ft. deep and having maximum chord stresses approximating 1,000,000 lb., has recently been completed by the Pacific Iron & Steel Company, of Los Angeles. It forms a portion of an all-welded steel frame carrying a part of an addition being made to the existing mausoleum and columbarium of the Forest Lawn Memorial Park Association, in Glendale, Calif. The maximum loads on this heavy truss are believed to be the largest thus far trasmitted by welded joints in a building or bridge frame, and necessitated the use of gusset plates and slot welds of unusual dimensions. The new addition carried by the steel frame extends over and is a part of the existing building, which was of such design that the new loads were required to be carried on an independent frame.

The welded frame consists of three trusses, 36, 60 and 96 ft. long, respectively, together with the necessary floor and roof beams, as shown in Fig. 1. Reinforced-concrete floor and roof are utilized. The trusses are carried on steel columns, resting on reinforced-concrete footings placed about 25 ft. below the footings of the existing building and as close to the existing walls as possible. The long truss spans the entire width of the existing building. The 60-ft. truss spans one wing of the building, while the shortest truss is over an outside end wall.

Truss Make-up and Design—The trusses are somewhat irregular in panel lengths, because of the layout of the rooms and crypts. The 96-ft. truss design was complicated further by the requirement that a wide corridor must pass through it. This corridor opening, requiring K-bracing in the panels to either side of it, may be seen near the center of the truss in Fig. 1.

The trusses all have a depth of 17 ft. center to center of chords and are spaced 29 ft. apart. Constant depth sections are used for the members in order to avoid the use of fillers at intersections. By this arrangement the gusset plates could be welded on both sides of the top and bottom chords in the shop, and assembling in the field could be accomplished by merely setting the web members in place. Owing to the practical impossibility of erecting these trusses as units, the two long trusses were assembled in place in a vertical position and then welded. The long truss was given a camber of 1 in., and when the blocking was removed and the truss swung free, one-half of this camber remained. It is quite probable that under the final load the chords will be practically horizontal.

The trusses were designed for the maximum stresses resulting from either (1) full load, (2) right half loaded or (3) left half loaded. The 96-ft. truss is designed for an equivalent uniformly distributed load of approximately 17,500 lb. per foot, and the 60-ft. truss for a similar load of approximately 20,000 lb. per foot, the latter being so designed that an additional bay of 29 ft. may be installed at a future time.

All welds were designed to act either in shear or compression, care being taken that no joint should be subjected to tension. Welds were made in accordance with the best modern practice, being applied in successive beads, each bead being peened and cleaned with a wire brush before the application of any new metal.

The amount of shop work on this frame was very small, consisting of the welding of some of the gusset

plates, the cutting of the various members to correct length, and the notching or coping of some of the members for proper assembling. There was also required the punching or drilling of a few bolt holes to provide field assembly connections.

Unique Gussets—Roof trusses of arc-welded construction have become fairly common, and an absence of gusset plates is one characteristic which distinguishes many of them from their riveted counterparts. For trusses carrying heavy loads, however, the overlapping of web members on chord members does not afford sufficient length of contact to permit development of required strength by means of welding along the edges of the web members, and recourse must be had to gusset plates as in riveted construction. Although the general arrangement of members and gusset plates resembles riveted construction, the concentration of strength afforded by suitably designed welded joints makes possible the development of the needed strength within a space much smaller than that required for a riveted joint to serve the same purpose.

A comparison made during the design of the trusses for this mausoleum illustrates this point. For instance, in considering the maximum strength concentration obtainable under usual specifications in a gusset plate with $\frac{7}{8}$-in. rivets having a single shear value of 8,100 lb., it was found that, with a staggered arrangement, the rivets might be spaced so as to occupy about 6 sq.in. of plate per rivet, although this would be rather too close for first-class practice. However, assuming 6 sq.in. of plate per rivet, this would mean that 1,300 lb. per square inch of plate is about the limiting rate of stress transfer with $\frac{7}{8}$-in. rivets. Slot welds, on the other hand, were found to provide far higher rates of stress transfer. For instance, it is good practice to allow a shearing stress of 11,300 lb. per square inch at the bottom of a welded slot, provided the slot width be greater than the depth but not more than twice the depth. This stipulation was satisfied

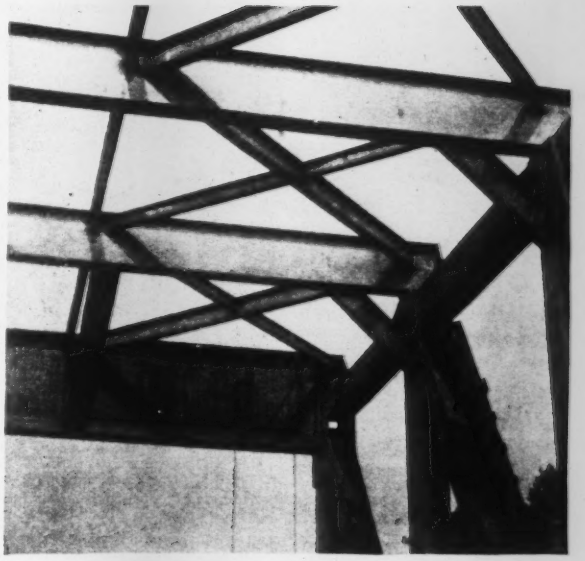


FIG. 2—OVERHEAD FRAMING OF HEAVY WELDED STRUCTURE FOR CALIFORNIA MAUSOLEUM

by the 1-in. gusset plates and the $1\frac{1}{4}$-in. width of slots in the mausoleum trusses.

The working stress for the slot welds was 14,000 lb. per linear inch. The minimum spacing of parallel slot welds is governed by their length and the thickness of the gusset plate. For example, parallel slot welds of the section employed on this job and 8 in. long may be used to transfer 110,000 lb. each, this stress requiring a strip of gusset plate 1 in. thick by about 6 in. wide in order to avoid excessive tension in the plate material. In the comparison cited above, the slot welds may be spaced about 6 in. on centers and transfer in excess of 2,000 lb. per square inch of plate. In other words, strength of the

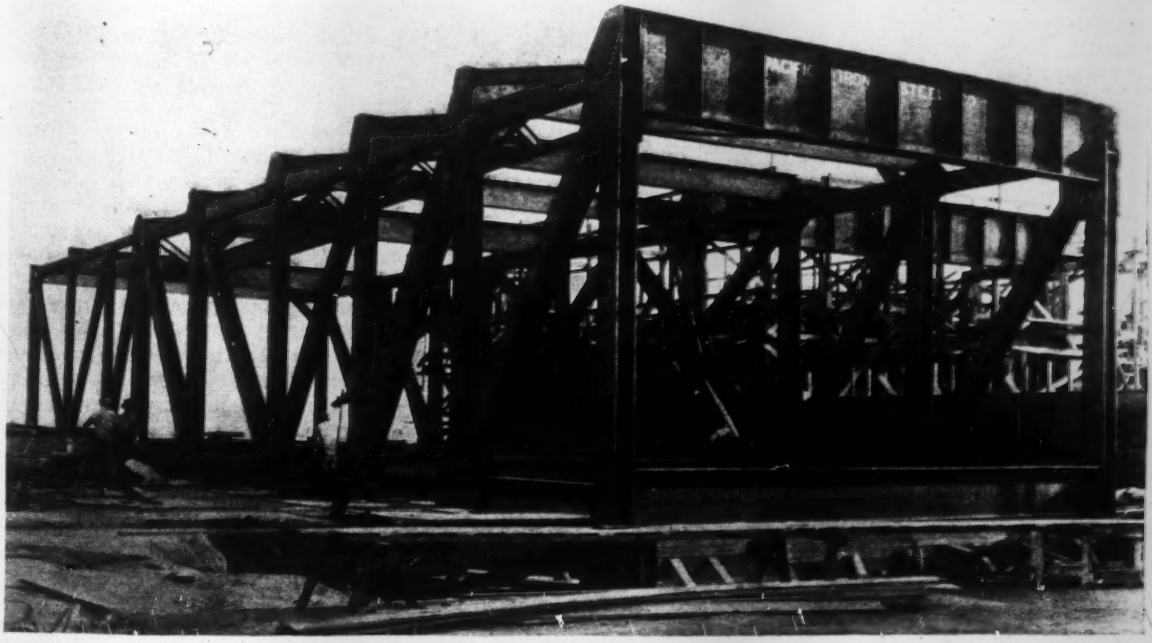


FIG. 1—WELDED STEEL TRUSS FRAMEWORK SPANNING EXISTING MAUSOLEUM

Trusses 17 ft. deep. Truss at far side has span of 96 ft., with maximum chord stresses of approximately 1,000,000 lb. Note in center of this truss the portal arrangement of web members made necessary to accommodate a hallway. Note also use of large gusset plates whose connections to chords and web members are made by slot welds.

FIG. 3—WELDING GENERATOR FOR HEAVIEST WELDING JOB
K-framing in third panel of truss necessary because of hallway opening through fourth panel.

gusset plate is the critical factor in determining rate of stress transfer by means of slot welds.

The gusset plates of the Forest Lawn trusses have been modeled after those recently employed as an innovation on the Chicopee Falls railway bridge of the Westinghouse Electric & Manufacturing Company near Springfield, Mass. That bridge, completed in 1928, established the practicability and economy of slot-welded gusset plates in heavy truss construction. The largest of the Forest Lawn trusses, because of the mass of concrete which it supports, is heavier and requires heavier joints than the Chicopee Falls trusses, which were half again as long and were designed for Cooper's E-50 locomotive loading.

The welders who worked on the Forest Lawn mausoleum were required to make several test welds and demonstrate their efficiency to the satisfaction of the inspector of welding, who had entire supervision of this portion of the work both in the shop and in the field. This inspection was very thorough and yet there were few instances of unsatisfactory workmanship which would require the cutting out and rewelding of connections.

H. A. Lund, of Los Angeles, designed the steel frame, which was checked by F. N. Ropp, consulting engineer, Los Angeles. According to Gilbert D. Fish, consulting engineer of the Westinghouse Electric & Manufacturing Company, who consulted with Mr. Lund on the design of the welded joints, the use of welding instead of riveting in this structure has made possible a saving of from 12 to 15 per cent in the total quantity of steel employed, largely by reason of a reduction in the size of gusset plates and also in the size of tension members, since the section of these members was not reduced by rivet holes.

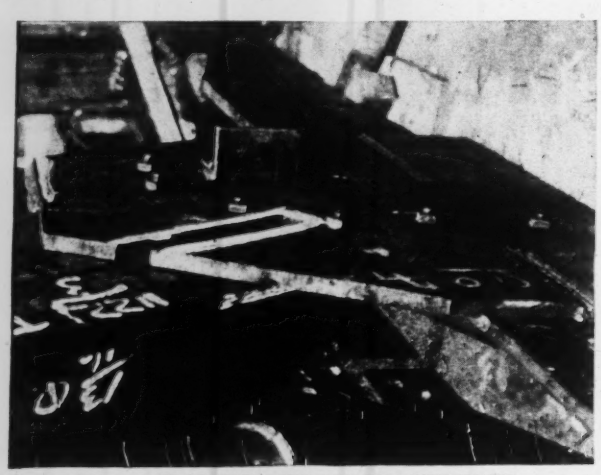


FIG. 4—SLOT-WELDED JOINT ASSEMBLED AND READY FOR WELDER

Railway Developments in Japan

EXTENSIVE improvements in the government railway system of Japan are noted in the 1928 report (recently issued) of the Department of Railways. The system then comprised 8,290 miles of line, with 1,166 miles of double track, 91 miles with three or four tracks and a total trackage of 13,621 miles, all of 3½-ft. gage. There were 665 miles under construction and 2,136 miles authorized, all these new lines being in twelve districts, with a construction office for each district.

Important works on these new lines or extensions include the 6-mile Shimizu tunnel on the North Joetsu line, about 65 per cent completed, and the 5-mile Tanna tunnel on the Atami line, now 75 per cent completed. A description of the great difficulties encountered in the Tanna tunnel will be given later in *Engineering News-Record*.

Improvements on existing lines include double tracking, line revision, freight yards, new bridges, enlargement of tunnels and heavier track construction. Electric operation is established between Tokyo and Atami and on some shorter stretches of line. The motive-power equipment now includes 4,022 steam locomotives and 92 electric locomotives, with 21 shop plants for repair and construction. Service between the railways of the main islands is maintained by five train-ferry lines with 33 steamers.

Private railways number 219 with 3,407 miles of line. Most of these are operated by steam, but some have electric operation. In addition there were 3,513 miles under construction for 269 different lines, most of these being for electric traction, two for gasoline and the remainder for steam. A large proportion of these private lines have joint traffic arrangements with the government railways. There were also 157 tramway lines aggregating 1,610 miles, while 101 lines aggregating 720 miles were under construction. These are mainly steam, electric or gasoline operated, but 26 are for horse traction and fifteen for "human power," these last 41 lines evidently being for industrial or plant service.

Of the state-owned colonial lines, the largest system is that in Chosen (Korea), with 1,456 miles, but this is operated by the South Manchuria Railway Company, in addition to its own 690-mile system, under an agreement with the government of Japan, which itself established the company in 1906 to operate the railways acquired by the Russo-Japanese war. All these lines are of the standard gage. There are also 1,000 miles under construction. Private or local lines in Chosen aggregate 515 miles, with 55 miles under construction. In Taiwan (Formosa) there are 537 miles of government railway and about 340 miles of private railways, but most of the latter are industrial lines. In South Karafuto (the Japanese portion of Saghalien) the government has 156 miles of line (3½-ft. gage), and there are two private lines aggregating 118 miles.

Rockfilled Pile Foundations for Columbia River Lights

Use of Piling to Hold Rockfill Is a Feature of the Design, Which Was Necessitated by the Serious Maintenance Problem

By C. F. Ganong
Assistant Lighthouse Engineer, Portland, Ore.

THE maintenance of navigation lights on pile structures in the Columbia River by the U. S. Lighthouse Service has been difficult and expensive in some locations because of the strong sweep of the current. Particularly has this been so at Lower Sands light and Tongue Point Channel range front light, where the velocity of the current is at times in excess of 6 miles per hour. The former light was established in 1903. Since then the structure has been rebuilt many times, five times since 1914. The Tongue Point light structure was originally built in 1914. Since that time the light has been rebuilt nine times.

Because of the insistence of local pilots that lights be maintained in these locations, the Lighthouse Service was faced with the problem of building structures of a permanent character, the first cost of which would not be excessive. A type of structure was designed and built that is believed suitable for the locations, consisting of piles and rock below water, upon which is superimposed a pier of reinforced concrete. (See Fig. 1.) Since the structures have been completed two vertical fenders have been added to protect the small boat of the caretaker of the lights when he visits the structures at certain stages of tide.

Use of piling to hold a rockfill is the feature of this type of structure, and this is feasible only where good penetration for piles can be obtained, where the bottom is firm sand and where the piles are not subject to the attacks of marine wood borers. These conditions obtain at most locations in the Columbia River.

The structure for Lower Sands light was located in about 24 ft. of water at mean lower low water, the structure at Tongue Point in about 35 ft. Twenty-eight piles, including the center pile, were required for each structure. All were selected straight sticks of nearly uniform top and butt diameters of 12 and 22 in. respectively. The outside diameter of the circle of piles at the bottom was 17 ft. at Lower Sands and 20 ft. at Tongue Point. The piles for both structures were drawn in at the top to a circle having an outside diameter of 12 ft. Because of the greater depth of water, the piles at Tongue Point pulled together without much difficulty; at Lower Sands, however, three days was required to pull them in without breaking, piles being pulled tight and then allowed to stand over night before applying more strain on the pulling cable.

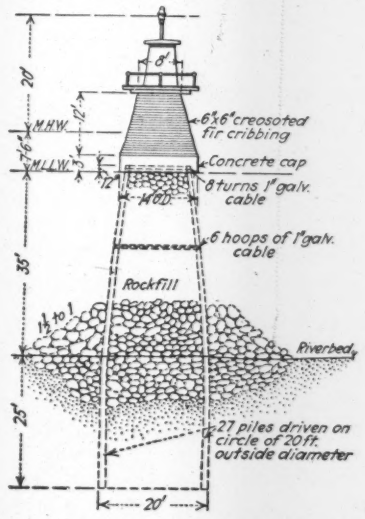


FIG. 1—STRUCTURE OF TONGUE POINT CHANNEL LIGHT

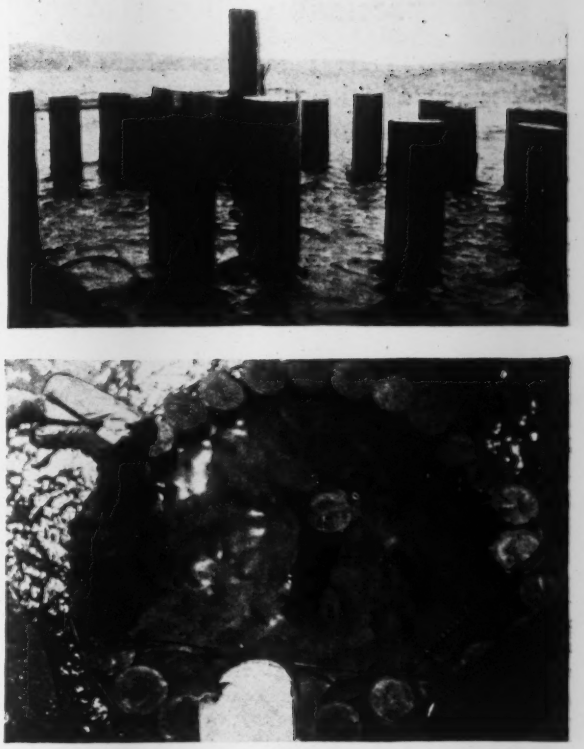


FIG. 2—PILE CLUSTER FOR LIGHTS
Above—Piles as driven. Below—Piles after having been drawn together.

A combination of water jet and drop hammer was used for driving. After a hole had been jetted into the bottom about 20 ft., the pile was dropped into the hole, butt end down, and then driven until the required penetration was reached. By using the jet, each pile was accurately driven plumb, radially around the center pile and close up to its neighbor. When hove together at the top, all piles were in close contact.

On account of the low cutoff of the piles it was necessary to schedule the work so as to build the form and concrete the cap at a minus stage of the tide. Fig. 2 shows two stages of the construction of the Tongue Point light.

This work forms a part of a project for improved aids to navigation on the Columbia River. It was carried out by the Gilpin Construction Company, of Portland, Ore., under the direction of the superintendent of lighthouses, Seventeenth District. The writer was in immediate charge of the work of locating the structures and inspecting their construction.

Supreme Court Takes Stand on Depreciation Allowance

Depreciation to Be Based on Present Value—Dissenting Opinion Advocates Depreciation Based on Costs

ALLOWANCE for depreciation in determining the rate base for a public utility cannot be limited by the original cost of the property owned by the utility, but should be determined upon the basis of the present value of the property, according to a decision rendered Jan. 6 by the U. S. Supreme Court in deciding the Baltimore street-railway case.

In a dissenting opinion written by Justice Brandeis, the present rate of return on the utilities investment was considered adequate, and the opinion was given that business practices demand that depreciation charges should be based upon the original cost of the property, rather than upon its present value.

The case was brought before the Supreme Court on appeal from a decree of the Court of Appeals of Maryland, which upheld an order of the state Public Service Commission limiting the rate of passenger fares to be charged by the United Railways & Electric Company, of Baltimore, to 10c. for a single fare, or four tokens for 35c. The railway company requested an increase in fare to 10c. straight and charged that the rate of return under the old fare schedule was confiscatory and in violation of the Fourteenth Amendment.

The present value of the property was fixed by the Public Service Commission of Maryland at $75,000,000, including an item of $5,000,000 as the value for easements in the streets of Baltimore. This latter item was challenged by counsel for the commission for the first time in the history of the case. The court did not consider this challenge. The rate of fare allowed by the commission permitted the company to earn a return of 6.26 per cent on this valuation, and this return the court found "clearly inadequate."

Rate of Return

The return, said the court, should be reasonably sufficient to assure confidence in the financial soundness of the utility, and should be adequate to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties. The court "is not certain that rates securing a return of 7½ or even 8 per cent on the value of the property would not be necessary to avoid confiscation." The rate of return requested by the commission, 7.44 per cent, was therefore held to be reasonable and necessary to prevent a violation of the Fourteenth Amendment.

The commission sought a review of the question in respect of the annual depreciation allowance, which had been set by the commission on the basis of the original cost of the plant. The depreciation allowance is defined to be the amount necessary to be set aside periodically "to restore property worn out or impaired, so as continually to maintain it as nearly as possible at the same level of efficiency for the public service." This calls for expenditures equal to the cost of the worn-out equipment at the time of its replacement and therefore should be based on present values. "It is the settled rule of this court that the rate base is present value, and it would be wholly illogical to adopt a different rule for depreciation."

In a dissenting opinion, concurred in by Justices Holmes and Stone, Justice Brandeis contends that a net return of 6.26 per cent on the present value of the property under consideration seems to be compensatory. "However, the estimated return is in fact much larger, if the rules which I deem applicable are followed," says Justice Brandeis.

Capitalization of Franchises

The item of $5,000,000, representing the value placed upon the railway's so-called "easements," should be excluded from the rate base, because, regardless of their present denomination, the easements referred to are in effect franchises and are therefore incapable of capitalization under the laws of Maryland. Franchises to lay tracks in the public streets are not donations to a utility of property by the use of which profit can be made. They are privileges granted to utilities to enable them to employ their property in the public service and to make profit out of such use of that property. If this item were excluded, the estimated yield would be increased to 6.70 per cent, on a $70,000,000 rate base.

In a long discussion of depreciation allowance, Justice Brandeis holds such allowance to be the amount to be set aside annually from earnings to retire the investment represented by the plant at the time that plant reaches the end of its useful life. It is included in the annual accounting as a cost or expense item, to the end that the annual profit or loss might be ascertained, and represents one single year's share of the cost of those plant units having fairly long life. This naturally requires that the annual depreciation charge be based on original cost.

"To use as a measure of the year's consumption of plant a depreciation charge based on fluctuating present values substitutes conjecture for experience. Such a system would require the consumer of today to pay for an assumed operating expense which has never incurred and which may never arise."

If the yearly expense included a depreciation charge based on original cost instead of present value, the rate of return of the railways would be further increased to 7.78 per cent.

In closing, Justice Brandeis pointed to the fact that the railways had paid dividends on the common stock for the five years preceding the filing of the case, although they had not been granted the advantage of the higher depreciation allowance based on present value. If the accounts of the railways are revised by charging the higher depreciation allowance, it is found that no profits were earned after 1924 and that there was no surplus fund from which dividends could have been paid legally. "If the contention now urged by the railways is sound, the management misrepresented by its published accounts its financial condition and the results of operation of the several years; and it paid dividends in violation of law."

An additional dissenting opinion was written by Justice Stone, in which he declares that he agrees with what Justice Brandeis has said and contends further that the holding that the present price level is necessarily the true measure of future replacement costs of the properties of a public utility "is to substitute for a relevant fact which I should have thought ought to be established as are other facts, a rule of law" which is founded on neither experience nor expert opinion and is unworkable in practice.

Steel Erection Problems on a 1,000-Ft. Building

On Chrysler Building, New York City, Narrow Setbacks and Tall Sheer Tower Necessitate Steel Landing Platforms—185-Ft. Finial Lifted in One Piece

MEASURED as the Woolworth Building has always been measured—that is, to the top of the highest peak—the new Chrysler Building in New York City is 1,044 ft. above the sidewalk. In erecting the 21,000 tons of structural steel in the building several unusual problems were encountered, although in general the erection methods closely followed those now in common use. The setbacks on the building were narrow, requiring the use of steel landing or transfer platforms. At the top of the building a finial spire 185 ft. high was required to be erected as a unit. In the lower stories of the building several unusually heavy

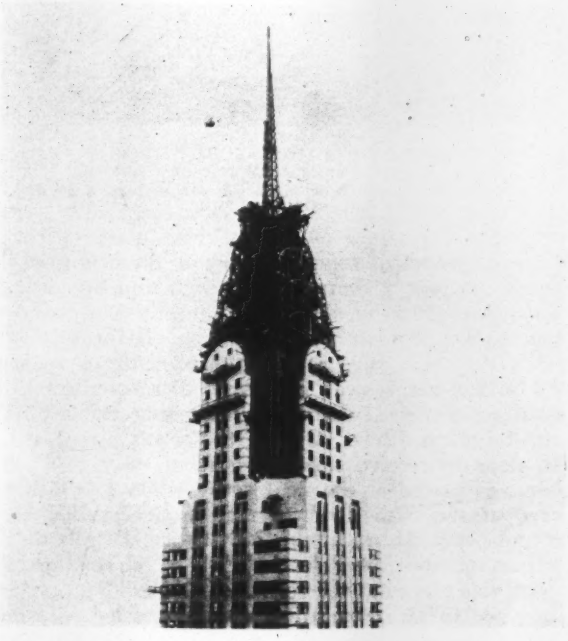


FIG. 1—TOPPING-OUT STEEL ON CHRYSLER BUILDING, NEW YORK CITY
Last piece of steel erected was a finial spire 185 ft. high, shown being lifted verticaly from within the building. Note complicated steelwork in dome of building.

column sections occurred as well as several two-story trusses, the erection of which, while not difficult, was an exacting and slow operation.

The Chrysler Building, in its lower stories, is trapezoidal in plan, approximately 200 ft. on a side, reducing by means of four setbacks to a rectangular tower 107½x88 ft. in plan at the 31st floor. This tower rises to the 66th floor, the only setback notching its sheer face occurring at the 59th floor.

Steel erection was begun with five derricks, which were utilized for the first 24 floors. Two of these derricks were of 30-ton and three of 20-ton capacity.

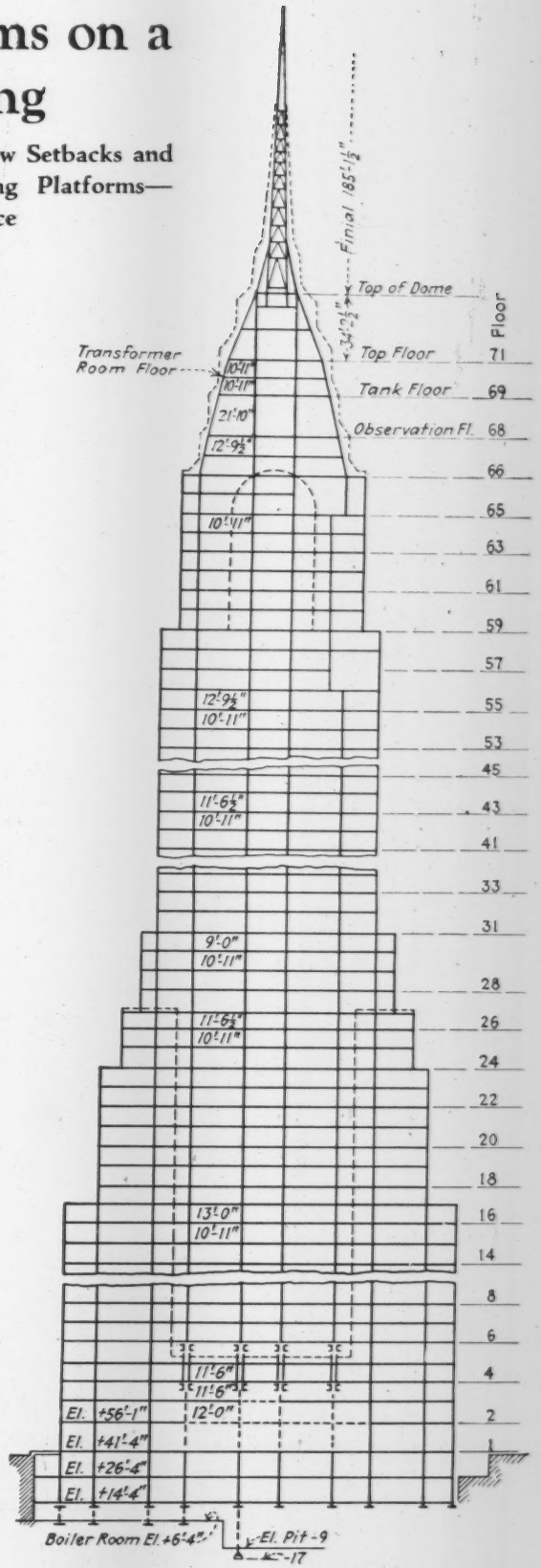


FIG. 2—DIAGRAMMATIC SECTION THROUGH CHRYSLER BUILDING

All were guy derricks with 75-ft. booms. Three of the derricks were discontinued at the 24th floor, and a 20-ton stiff-leg was added, placed on the street side of the building at the 26th floor setback to serve as a transfer derrick at the landing platform. Two guy derricks—a 15-ton and a 20-ton—erected the tower. At the 59th floor setback, the 15-ton derrick was shifted to the edge of the building to serve as a second transfer derrick while the 20-ton derrick completed the building, its highest position being shown in Fig. 2 at a height approximately equal to the 74th floor.

In the lower stories of the building several heavy pieces had to be erected. A section of the heaviest column in the building is shown in Fig. 3. The lifting weight of the erection piece of this column was approximately 25 tons. In make-up this column is typical of those which supported one end of the four two-story trusses (Figs. 2 and 4); each of the columns carried a load of approximately 7,000,000 lb. The trusses, also, comprise unusually heavy structural work, and were completely assembled in place in the field, so that each lifting piece was somewhat lighter than the heavy column sections.

Maximum speed in steel building erection is largely dependent upon the proper use of the derricks. That is, by having several derricks lift the steel a certain number of stories and by having other derricks engaged exclusively in setting steel, all derricks can work at fast speeds, since the lifts are not unreasonably great; also

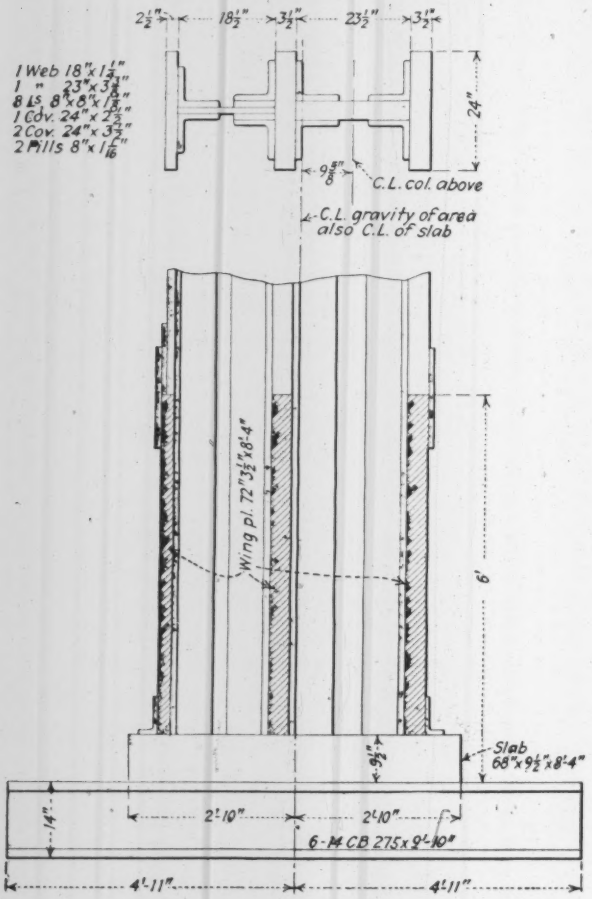


FIG. 3—MAKE-UP OF HEAVIEST COLUMN SECTION IN CHRYSLER BUILDING

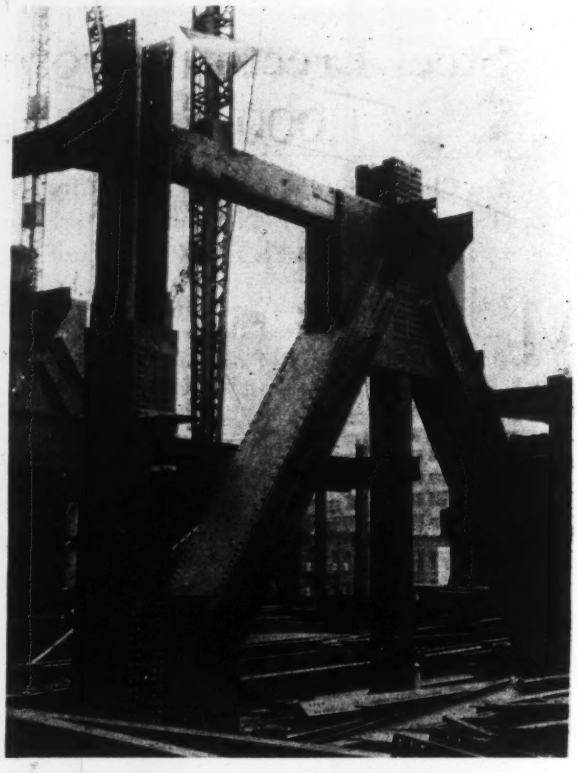


FIG. 4—ERECTING A TWO-STORY TRUSS IN THE CHRYSLER BUILDING
Note on near column how upper section is turned 90 deg. and rests on a billet.

the small amount of rope necessary on the drums of the hoisting machinery contributes to high rope speeds.

Lifting or transfer derricks ordinarily are placed at setbacks, the roof forming a landing platform for the steel. In the Chrysler Building these setbacks are only 9 ft. wide, and it was necessary therefore to utilize special cantilevered platforms, increasing the available width by about 12 ft. One of these was placed at the 26th floor to receive steel lifted from the street. The other was placed at the next setback above, which occurred at the 59th floor, to receive steel raised from the transfer platform at the 26th floor. Details of the platform at the lower level (Fig. 5) show how the derrick was placed at the corner of the building, making it possible to utilize a stiff-leg type, one leg of which could be anchored along the setback roof.

Erection of the steel in the main body of the building between about the sixth and 66th floors was carried out by usual methods. Columns came from the shop in two-story lengths with the wind connection details riveted to them. Floor steel was largely of rolled sections. Erection of each tier was begun with the outside panels and progressed inward, gradually inclosing the derricks.

In the dome, steel erection was an exacting task because of the complicated nature of the framework, which may be seen in Fig. 1. Some of this, particularly the bent angles, is unusual in building construction and had to be fabricated in a ship-building shop.

The top of the building is surmounted by a finial spire 185 ft. high and 8 ft. square at the base. The structural make-up of the finial is simple, consisting of four corner

angles, light angle struts and V-type angle bracing. It was expedient to erect this spire as a unit, but because of its weight of 27 tons, it was not possible to pick it directly from the street. Also it would have been a difficult task to up-end it when it reached the top of the building. Therefore it was decided to assemble the tower in a vertical position inside of the building and immediately below its final location, and then to hoist it vertically into place. In order to carry this out it was necessary to omit some of the floor framing in the building, but fortunately this was of a minor character so that no alterations in the building design were necessary as a result of using this special top piece.

The finial spire was fabricated and hauled to the building in five units. By providing a support for the base of the finial at the 65th floor, the top field splice was accessible from the top erection platform. The support at the 65th floor consisted of two 12x12 timbers, 20 ft. long, placed across the floor framing.

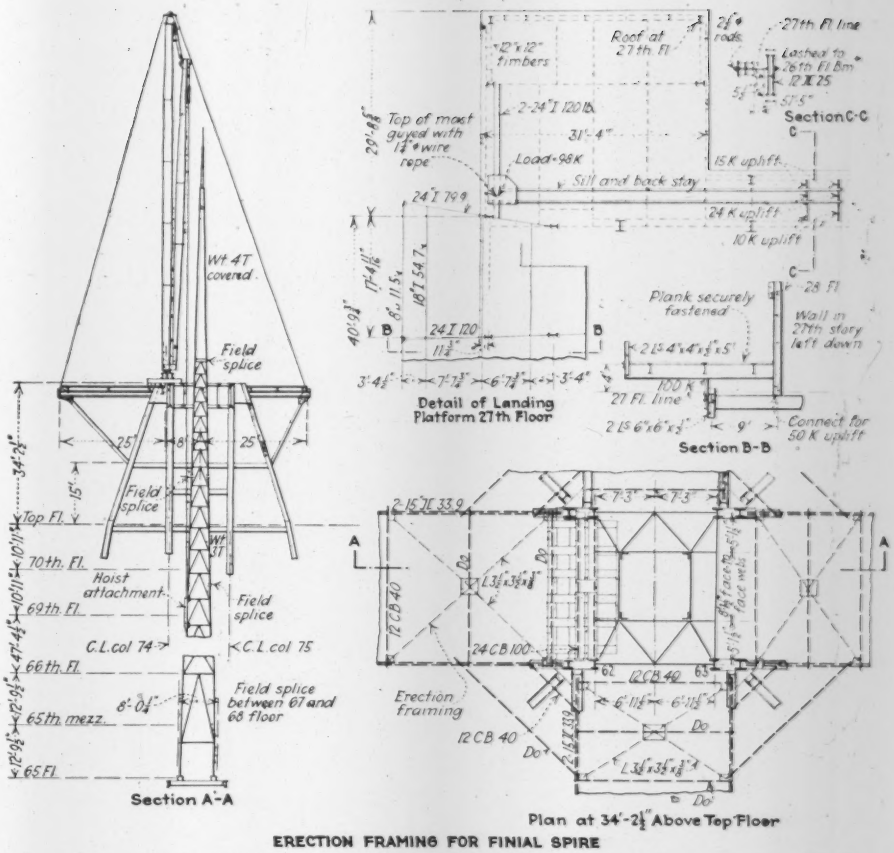


FIG. 5—DETAILS OF STEEL ERECTION EQUIPMENT ON CHRYSLER BUILDING

In order to provide a working platform and also a support for the guy derricks, an outrigger platform was erected completely around the top of the dome, as shown in Fig. 5. It was necessary to make this platform unusually wide so that the guys from the top of the derrick mast would not have too steep a slope. The derrick mast was placed close to the edge of the opening in the roof and the boom pulled up tight against it. A hoisting connection was provided on the finial spire approximately at its center of gravity. Falls from the boom head were attached to the finial and it was lifted vertically into position. Although the derrick used was rated at 20 tons, this was with a flat boom so that with the boom in a vertical position the derrick had ample capacity to lift the 27-ton finial.

Post & McCord, New York City, were the steel contractors on the building. Fred T. Ley & Company, New York City, were the general contractors. W. R. Squire & Son and H. G. Balcom designed the steel. William Van Alen was the architect. All work was done under the general direction of Frank B. Rogers, vice-president, Walter P. Chrysler Building Corporation.

Bond Issues Fare Badly in Ohio Cities

Of 35 water and sewer bond issues submitted to the voters of Ohio cities for approval at the November election, twenty, involving a total of $9,670,276, were defeated, and fifteen, totaling $2,036,730, were approved, according to the December issue of *Ohio Health News*, the official bulletin of the state health department. The defeats included the two largest projects involved, both sewerage, a $4,500,000 issue by Akron and a $3,000,000 issue by Cleveland. A $970,000 issue approved at Lima and a $475,000 issue at Norwalk will enable these municipalities to construct sewage-works. The most important water bond issue carried was $100,000, for a new reservoir and filtration plant at Delta. Although a majority voted in favor of the issues at both Akron and Cleveland, the 55 per cent vote necessary for authorization was not obtained. According to F. H. Waring, chief engineer of the Ohio Department of Health, lack of proper publicity and the present climbing tax rate are the chief reasons for the defeat.

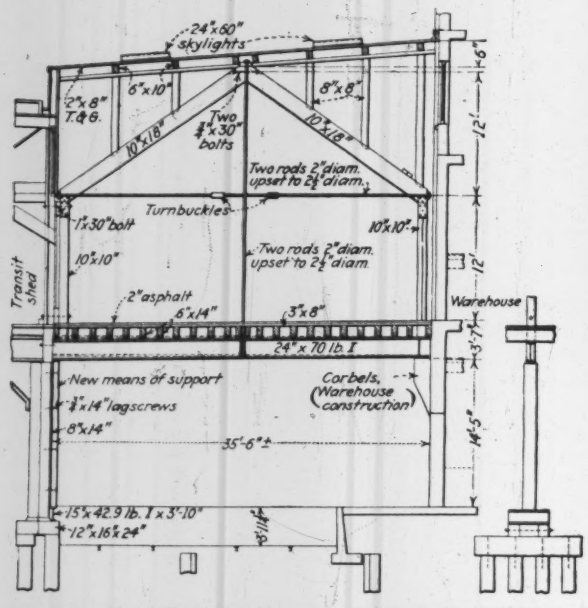
Improvised Snow Fence for Roads

A snow fence of wire and burlap sacks was erected to prevent the blocking of a highway near Warsaw, Ind., by drifts during recent heavy snowstorms. Two wires 3 ft. apart, with the lower one near the ground, were strung on steel posts 100 ft. back from the road for a distance of about 1,100 ft. and hundreds of sacks were attached to these by hog rings, open spaces being left between the sacks. This fence checked the wind so that the snow formed a drift behind the fence instead of being carried over into the road. The posts were those carried in stock by the highway department for road signs, and the sacks accumulated last summer when calcium chloride was used on the roads to prevent dust. The wire was purchased. This fence was built by Frank M. Schwab, superintendent of maintenance of the Indiana Highway Commission, and is said to have cost only $25.

Roof Trusses Carry Floor, as Tracks Below Prevent Using Columns

Warehouse Space Over Railroad in Seattle Utilized by Novel Method of Supporting Load from Above

A-FRAME trusses were used last summer as floor supports for the second story of a Seattle waterfront warehouse where horizontal and vertical clearances of the railroad tracks beneath prevented carrying the second-story load on (1) beams with column supports between the tracks or on (2) deep girders spanning the space between the two buildings. The space involved is between the Bell St. warehouse and the adjacent transit shed, the tracks of the Port Commission railroad serving the Bell St. terminal passing between the two structures, both two stories or more in height at this point.

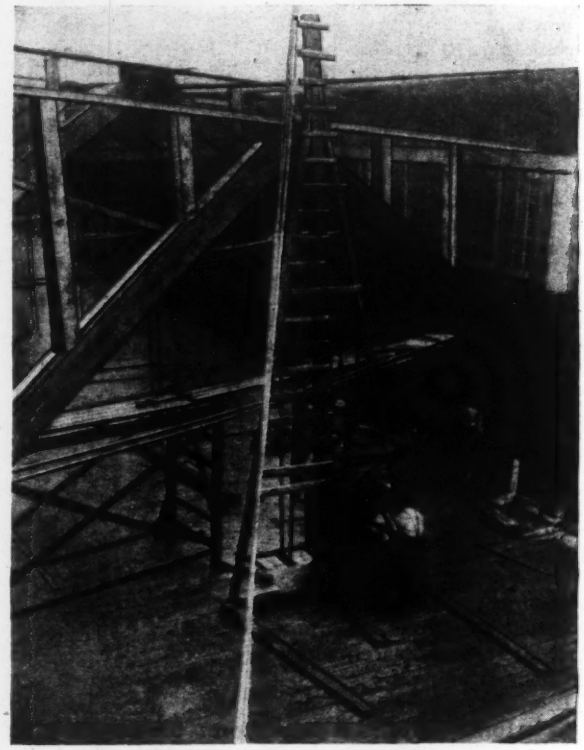


ELEVATION OF FLOOR AND SUSPENDED SUPPORT BETWEEN WAREHOUSE AND TRANSIT SHED

By use of overhead support it was possible to add to the storage space an area approximately 35x400 ft.

When the Bell St. warehouse was designed it was intended to utilize this space over the railroad tracks. This was to be done merely by extending the second floor area, and with a view to facilitating this, extension corbels for the floorbeams were put in on the columns of the warehouse. Later, when the Bell St. wharf and transit shed were built on the outshore side of the tracks, this plan was vetoed and it was decided not to make use of the space over the tracks. Accordingly, not only were corbels omitted from the columns of the transit shed but the column spacing was not made to correspond with that in the warehouse.

This year, on account of the urgent demand for more cargo space at this terminal, the original scheme was resurrected and it was decided to utilize the space over the tracks. Not only did it then become necessary to devise some new means of support in place of the corbels that had been omitted but because of the difference in column spacings on opposite sides of the tracks the floorbeams could not be carried across the tracks at right angles to the side walls. There was insufficient clearance between the tracks to permit the use of central columns, and as 18 ft. of overhead clearance above the tracks was the absolute minimum, no form of truss or deep



ERECTING A-FRAMES FOR SUPPORTING WAREHOUSE FLOOR

girder under the floor could be used to span between the two buildings.

The scheme employed was to use 24-in. 70-lb. steel girders, connecting columns on opposite sides of the tracks, and to support these girders at their center point by means of a pair of brackets welded to the web and hung from an A-frame above. The girders were cut to proper length by means of oxyacetylene torches and the brackets and web stiffeners were electrically welded in place.

On the outshore side of the tracks supports for the steel girders were provided by bolting 8x14-in. wooden columns to the face of the transit shed columns. The footings of the combined columns were reinforced and two piles driven to provide for the additional load.

The A-frames consisted of framed timbers 10x18 in. in section carrying two steel rods 2 in. in diameter, bent in hairpin shape and bearing on the apex of the A-frame through steel castings. The rods extended about 28 ft. from the apex of the A-frames to the connections with the steel girders below the floor level. The horizontal tension members of the A-frames were also 2-in. rods similar to the vertical rods. With this design, floor loads of 250 lb. per square foot are provided for. The wooden plank flooring was covered with an asphaltic wearing surface.

The design was developed under the direction of J. R. West, port engineer, port of Seattle.

City Engineer's Offices Planned for Public Service

Quarters in New City Hall at Columbus, Ohio, Laid Out for Convenience of Citizens and of the Office Personnel—Separate Design Room for Special Large Work

FEW CITY engineers have had an opportunity to plan their own offices. In the majority of cases they are given no choice in the matter, but are assigned space in an already crowded city hall. In Columbus, Ohio, however, precedents were disregarded, and R. H. Simpson, chief engineer for many years of the division of engineering and construction, Department of Public Service, is permanently located in the most desirable part of the new city hall in quarters of his own planning. The city hall is not yet completed and many departments of the city are still scattered in near-by office buildings, so that the preference given to the city engineer is the more remarkable.

FIG. 1—GENERAL OFFICE, CITY ENGINEER'S HEADQUARTERS, COLUMBUS, OHIO
All business with public handled over curved counter in center background. Complete indexes and files are within reach for answering all questions. Chief engineer's private office at left, while his assistant is in an office on the far side of the counter.

How would a city engineer plan his quarters and arrange his records if he were allowed free rein? A description of what has been done at Columbus is one answer. Briefly, it was based on a very simple plan—namely, to devise an arrangement of office rooms and office equipment that would make possible efficient public information service with the expenditure of a minimum amount of effort on the part of the public itself and at the same time would provide privacy and favorable working conditions for the engineering department's staff of clerks and engineers.

The new city hall, or the part which is now completed, is U-shaped, as shown in Fig. 2. The city engineering department occupies all of the third floor of the north wing, this location being chosen because it was somewhat off the beaten path of the casual visitor, and also because of the availability of skylights in addition to windows. A noteworthy feature of the layout is that the routine work involved in handling building permits, complaints, house-numbering problems and similar matters has been entirely separated from the main office. At the same time the arrangement is made particularly convenient for the public by utilizing a long counter placed along the front side of the building permit room as the wall between this room and the main hallway. The maintenance engineer, who has close contact with the public at all times, has his office adjacent to this counter, so that he is available to adjust complaints. This engineer, whose place in the organization is shown by Fig. 4, is in charge of the maintenance of sewers and streets, with the exception of the asphalt plant and asphalt street repairs; he also handles the maintenance of bridges, but is assisted by the bridge engineer on any projects that require careful attention. Incidentally, his work is assuming such proportions that it will soon be necessary to divide the duties of the maintenance engineer and have one man in charge of sewer maintenance and another in charge of street maintenance.

Provision also is made for serving the public in the general office. A semicircular counter keeps visitors from entering the main part of the office and contributes markedly to staff efficiency. Complete records in the form of card indexes and files are kept near this counter in order that all questions may be answered with despatch and a minimum of trouble. For instance, the files under the counter contain copies of all correspondence; all papers and contracts relative to street improvements, sewer, bridge and viaduct construction; contracts for materials; street and alley, sewer and drain maintenance plans and specifications, and other things.

This main office counter filing system is based primarily upon location, since practically all questions asked by the public refer to a project by its street location. The secondary consideration in the filing system is

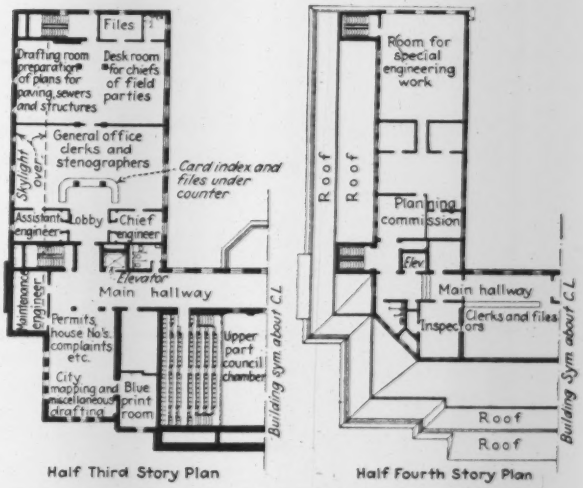


FIG. 2—LAYOUT OF CITY ENGINEERING HEADQUARTERS IN NEW CITY HALL, COLUMBUS, OHIO
Main office on third floor. Special design quarters and planning commission on fourth floor. Note how layout of main office keeps public from interfering with office work and at the same time contributes to convenience and speed in answering the public's questions.

the subject, and each subject is given a master number as below:

Employees, general orders, bulletins, etc.	100
Street improvements	200
Sewer construction	300
Street maintenance and repair	400
Sewer maintenance and repair; house services, etc.	500
Sidewalks and driveways	600
Requests for grades	700
Additions, subdivisions, deeds, surveys, house numbers, etc.	800
Accounts, operating appropriations, materials, and purchases	900
Special construction such as grade-crossing elimination projects, bridge construction and bridge and viaduct repairs	1,000
Miscellaneous	1,100
Copies of special legislation	1,200

Automobile - Ordinance to Purchase	A-120.0
Asphalt Plant - Ordinance Purchase Equipment	A-120.1
Assessments - Ordinance to correct	A-120.2
Appropriation - Ordinance	A-120.3
Additions & Subdivisions	A-120.4
Annexation - Ordinances	A-120.5
Automobile - Advertisements	A-120.6
Appraisals - Ordinance to pay	A-120.7
Air Compressor - Ord. (see file A-901)	A-120.8

A-120.0

FIG. 3—SAMPLE INDEX CARD ON WHICH COMPLETE FILING SYSTEM IS BASED

These master numbers are then further subdivided by prefixing an appropriate letter of the alphabet, such as:

Employees—Orders—Bulletins, etc.	100
Simpson	S-100
Orders	O-104
Bulletins	B-105
Street improvements	200
High St., Fifth Ave. to Dodridge St.	H-213
Palmetto Ave., Westmoor Ave. to Brinker Ave.	P-220

All of this information is shown on cards arranged alphabetically in numbered trays. One of these cards is shown in Fig. 3.

The small cabinet shown on top of the counter in Fig. 1 contains the index to the files beneath the counter and also contains a record of the proceedings in connection with all of the various improvements, such as street,

FIG. 5—DRAFTING AND DESIGNING ROOM FOR SPECIAL ENGINEERING STRUCTURES
This room on the fourth floor is apart from all routine activities. At present the special engineering work in Columbus centers on sewer extensions and a new sewage-treatment plant.

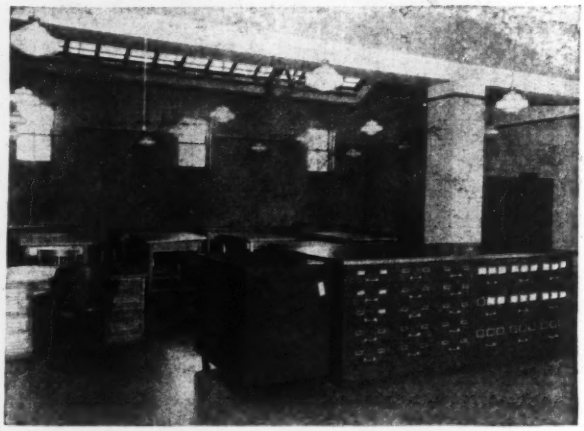


FIG. 6—MAIN DRAFTING ROOM, COLUMBUS, OHIO
Note high windows and skylights, also overhead artificial lighting.

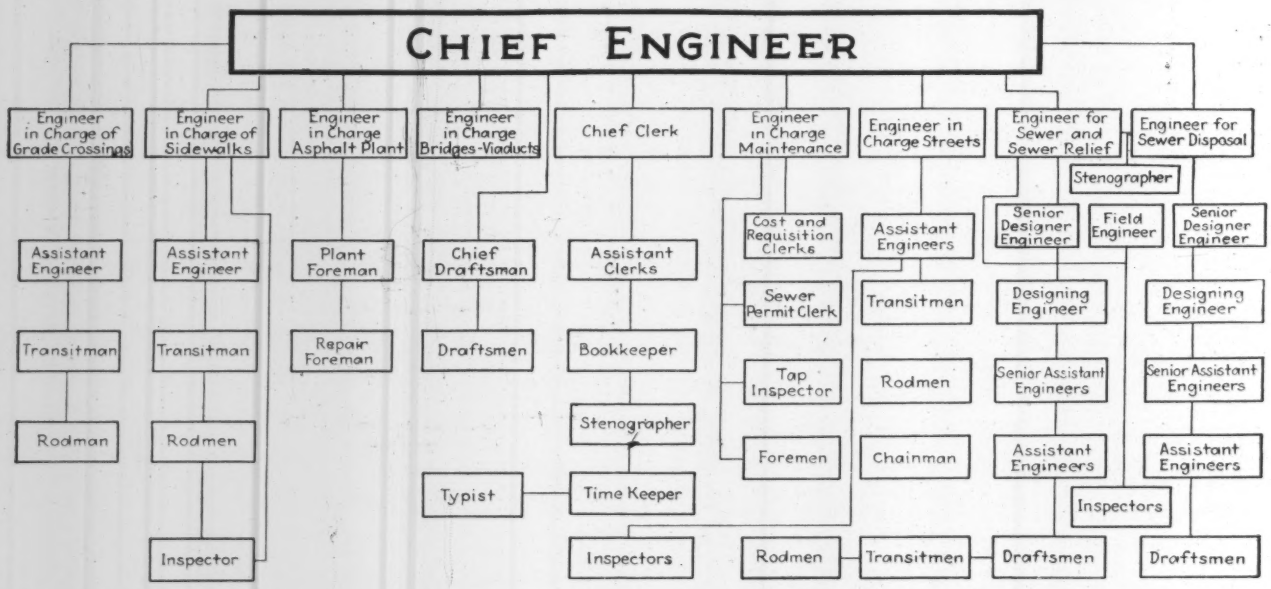


FIG. 4—ORGANIZATION CHART, DIVISION OF ENGINEERING AND CONSTRUCTION, COLUMBUS, OHIO

ENG. FORM 88 2M-5-29

TOTAL FRONTAGE	BOX NUMBER		RECORD NUMBER
SIGNED FRONTAGE	FILE NUMBER A-220		PAGE NUMBER
	OFFICE	COUNCIL	
PETITION RECEIVED			AWARDED TO
RESOLUTION FOR PLANS			CONTRACT DATE NO.
ST. & I. FUND NO.			COMPLETION DATE
RESOLUTION—NECESSITY			MATERIALS
ESTIMATED ASSESSMENT			SURETY
NOTICES SERVED			AMOUNT OF CONTRACT
BOARD OF REVIEW MEETS			AMOUNT AVAILABLE—CITY PORTION $
ORDINANCE TO PROCEED			AMOUNT AVAILABLE—PROPERTY PORTION $
NOTE ORDINANCE—P. P.			CERT. NO. C. P. INTERSECTIONS CREDITS
BIDS RECEIVED			ASSESSMENT RUNS YEARS GUARANTEE RUNS YEARS
FINAL ESTIMATE			ESTIMATED COST—CITY PORTION $
			ESTIMATED COST—PROPERTY PORTION $
			ACTUAL COST—CITY PORTION $
ESTIMATING BOARD			ACTUAL COST—PROPERTY PORTION $
ASSESSMENT PREPARED			ACTUAL COST—TOTAL $
ASSESSING ORDINANCE			RATE PER ASSESSABLE FOOT $
BOND ORDINANCE—P. P.			LENGTH WIDTH PAVING WIDTH STREET
			LENGTH WIDTH PAVING WIDTH STREET
			YARDS
			YARDS

ARCADIA AVE. INDIANOLA AVE. TO FOURTH ST.

STREET

MAINTENANCE COST

YEAR	AGE	SQ. YDS. REPAIRED	COST	COST PER YD.	SQ. YD. COST PER YEAR	TOTAL COST TO DATE

FIG. 7—STREET IMPROVEMENT CARD

This card is designed to give all information about a street improvement which is likely to be asked for. In addition a complete maintenance cost record of the street is kept on the reverse side of the card as shown.

sewer and sidewalk construction. The street improvement proceeding card, shown in Fig. 7, is designed to give all of the information that anyone might ask for. In addition to the ordinary information it sets forth the estimated city and property portion costs, together with the actual costs; the number of years the assessment runs; the length of the guaranty period; the rate per assessable foot; the length and width of the paving; the width of the street, and the unit price of the principal material used. The back of the card, also shown in Fig. 7, carries a record of the maintenance cost per square yard of paving after the guaranty period has expired.

The large steel cabinet, near by, houses deed books, assessment records, maintenance records, street names, etc. The plan file at the right, Fig. 1, houses drawings and plans of special work such as surveys of rivers and streams, encroachments, surveys of public property, etc.

All routine drafting and designing, together with the office work of the field forces, is confined to a large well-lighted room behind the general office. Here all plans for paving, sewers and structures are prepared. An important and successful practice has been inaugurated in Columbus to deal with special engineering problems such as the design work involved in new waterworks additions, new sewage plants, large drainage problems, special bridges, etc. Some such project invariably is under way and the work on it has no connection with the routine city engineering work. Therefore, at Columbus, special engineering work is carried out by a separate division of the city engineer's forces in a special room (Fig. 5) on the fourth floor. At present the special engineering work in Columbus centers on the design of new sewers and the enlargement of the sewage-treatment plant, a task of some years' duration.

On the fourth floor is also located the city planning commission, which is an advisory board to the city council. The commission has no official connection with the city engineer's office, but at the present time one of the city engineer's men has been assigned to handle the engineering work of the planning commission. His work has comprised various studies, principally in connection with the preparation of a major boulevard plan.

In Fig. 6 is shown a view of the main drafting room. The large steel cabinet contains profile books giving street elevations and grade lines before and after the improvements are made. The cabinet also houses the index to the profile books and the index to the plan file. All property maps are made in the outer office (Fig. 8), where permits are issued for sewer taps, driveway and sidewalk construction, street openings and house numbers.

Large files under the counter in this room hold the finished drawings of all sewers and the house number maps of the city. The finished sewer plans give the location of the sewer, the size and depth, and location of each tap; upon the issuance of a permit, the number of the permit is also shown.

In Fig. 8, the large file in the center of the room contains the original tracings and the prints of property maps, which are on a 60-ft. scale and form a complete record of the streets and subdivisions. The index to these maps is a master map divided into numbered squares, the sizes of which are proportionate to one of the property maps.

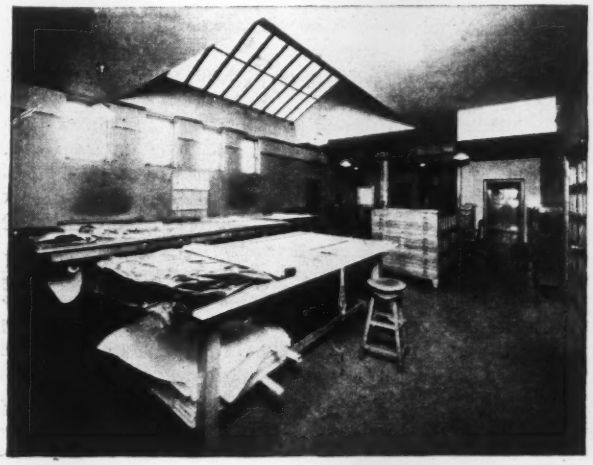


FIG. 8—CITY MAPPING AND MISCELLANEOUS DRAFTING ROOM

From counter in background are issued all permits and house numbers; and all complaints are handled there. Door to the left opens into the maintenance engineer's office.

Active Interest in Technical and Professional Matters at Civil Engineers' Meeting

Technical Division Meetings of American Society of Civil Engineers Well Attended and Papers Actively Discussed—Proposed Reclassification of Membership Meets With Considerable Opposition

Engineering News-Record Staff Report

SELDOM has there been such sustained interest in all phases of the annual meeting of the American Society of Civil Engineers as was shown at the meeting held in New York last week. The attendance was unprecedentedly large. Five active meetings of technical divisions were held.

The customary procedure of devoting Wednesday morning to the formalities of conferring honorary membership and the medals and prizes was followed, but a welcome innovation was made at the president's reception and banquet Wednesday evening by including in the event the presentation of the new honorary members. The formal presentation of the John Fritz medal to Ralph Modjeski also took place at that reception. J. V. W. Reynders, past-president of the American Institute of Mining and Metallurgical Engineers, presented Mr. Modjeski, and Dexter S. Kimball, past-president of the American Society of Mechanical Engineers, delivered the address of the occasion, taking "The Engineer in Human Progress" as his subject.

Committee Reports

An exhaustive report of the committee on engineering employment in public and quasi-public offices was presented by E. P. Goodrich, chairman of the committee, at the general session on Wednesday afternoon. This committee has collected and correlated a large mass of data on the salaries of engineers in public service.

The reports of the committees on stresses in railway track, earthquake stresses and irrigation hydraulics were not presented, as they have been printed and distributed.

Status of the Art

Four technical divisions submitted reports on "Status and Progress of the Art" at the Wednesday afternoon session. These reports are prepared with the object of informing the members in general upon the progress being made in fields of civil engineering other than their own. The highway division report was notable in that it devoted considerable space to the needs of that field rather than to past progress. Development of a low-cost method of treating earth roads was stated to be the greatest need of the present time. Other needs are data on fill settlement, the collection and interpretation of data on bases for brick and bituminous pavements, and real research, divorced from present ideas and practices, into traffic control.

In the power field, George A. Orrok, speaking for the power division, noted the extension of the use of propeller-type turbines as the most important recent development. He also commented upon the wide application of welding to penstocks, gates, trash racks and other parts of hydro-electric plants.

The use of activated carbon filters for the removal of tastes not otherwise easily removable such as that of phenol was reported by the sanitary division as being one of the most important developments in that field. The successful application of chlorination to the effluent from sewage-disposal plants and the prechlorination of sewage, also the successful use of small activated-sludge plants, were reported by the same division. Air conditioning was noted as being a growing field for sanitary engineers.

Completion of a manual on city surveys was reported by the surveying and mapping division. It will be ready for printing soon.

Power Division

State supervision of the design and construction of dams was the central theme around which the discussion of the power division centered. A paper on the subject by A. H. Markwart, vice-president of the Pacific Gas & Electric Company, San Francisco, served as the basis of discussion. H. deB. Parsons presented the paper in the absence of Mr. Markwart. Discussion was active and to the point, as the paper had been preprinted and distributed before the meeting to a number of men familiar with the subject.

The consensus of opinion was that as state supervision of the design and construction of dams is already an established fact in many states and is bound to come in the others, engineers should concentrate on setting up a basis for legislation on the subject. None of the speakers favored the preparation of any code of dam design and construction as part of that work, fearing that it would tend toward attempts to standardize dam construction.

Allen Hazen described a law recently under consideration in England under which the government would appoint panels of outstanding engineers for the supervision of various classes of dams. At stated intervals the owners of dams would be required to have their dams examined by a member or members of one of these panels. Upon the completion of the examination a report upon the condition of the dam must be made a matter of public record. A somewhat similar system which has been employed satisfactorily in Connecticut for the past 42 years was described by Charles Rufus Harte, of New Haven. In that state there is a board of prominent engineers named by the engineer of the commission on rivers and harbors. When a new dam is to be built one of these engineers must examine the plans and site and then periodically examine the work under construction. The dam may not be used until this engineer has given the owners a certificate of satisfactory performance. Members of the board are paid a fixed annual fee by the state and a small per diem fee when making reports. Membership on the commission is considered a distinction. The compensation is small.

The way in which control of dams works in states where such laws are in effect was outlined by E. H. Sargent, of Albany, F. W. Scheidenhelm, of New York, and Louis C. Hill, of Los Angeles. Mr. Hill warned

against the possibility of state control bodies extending their activities even to the point of furnishing plans in order to keep their men employed permanently.

A resoluton authorizing the executive committee to take up the consideration of a model law, either itself or through a committee, was passed at the close of the meeting.

Kill van Kull Arch Bridge

In two sessions occupying a full day the structural division considered the huge Kill van Kull arch bridge which the Port of New York Authority is building (see *Engineering News-Record*, Dec. 13, 1928, p. 873). Its design studies, engineering facts and erection method were described in two papers of exceptional interest, "Development of Plans and Research Work," by O. H. Ammann, chief engineer of bridges of the Port Authority, and "Structural Features and Proposed Method of Erection," by Allston Dana, engineer of design. Active discussion brought out many points of valuable comment.

The arch is 1,652 ft. long between pins and 1,675 ft. between abutments. It will carry four highway lanes and may be increased by adding two lanes or two rapid-transit tracks. The initial traffic volume is expected to be about one million vehicles, which will pay interest (apparently on a $1 toll) on the $17,000,000 which the entire project will cost. The Port Authority sold bonds for the bridge at 4 per cent a year ago.

Arch and suspension designs were carefully compared preliminary to the final design, after a cantilever project was ruled out by its high cost. The suspension design was slightly higher in cost, and because of its greater flexibility was considered less desirable. Hard rock being within 10 to 20 ft. of water surface, either type is feasible.

High-manganese steel with yield point of 55,000 and ultimate strength of 90,000 lb. per sq.in. was offered by the contractor in place of the nickel steel originally contemplated for the heaviest members. In the final design three materials are used, according to their economic justification: structural steel, silicon steel and manganese steel, rated at basic working stresses of 20,000, 27,000 and 33,000 respectively. Manganese-steel rivets also were offered and in tests proved to have about 60 per cent higher strength than ordinary rivets, so that they were accepted at 50 per cent higher unit stress.

The arch is being erected by successive cantilevering over temporary bents, the load being transferred at each change to the new advance bent by jacking. As the channel is south of the middle of the crossing, the positions of these bents are so limited that the north side of the arch must be cantilevered well beyond the middle to junction at about one-third the span from the south abutment.

Extensive tests on a model of the complete bridge as well as tests of members were carried out in the course of the development and in part are still going on. The model tests showed that swaybracing near midspan is much less effective in distributing load than swaybracing near the ends, and knowledge of this fact permitted considerable economy in the design.

Clarence W. Hudson, discussing Mr. Ammann's paper, commented on the narrowness of the arch, 74 ft., which is exceptional. Jonathan Jones, chief engineer of McClintic-Marshall Company, described the use of a suspension-bridge model in connection with the design of two suspension bridges shortly to be built, in order to predetermine such facts as saddle movement during erection and angular distortion of the cables by concentrated loads in erecting the trusses and floor. The cable distortion was a special issue in one design, where a plate-girder stiffening member is to be used. It was found that much longer girder sections could be placed in the end portions of the span than in the middle section for a given limit of cable bending.

L. S. Moisseiff, advisory engineer of design of the Port Authority, remarked that while the comparison of an arch and a suspension bridge had been made on a fair, comparable basis, nevertheless a cheaper suspension bridge could have been built on the 1,500-ft. span in question. Prof. C. M. Spofford suggested that a three-span continuous bridge might have been considered in the comparison with other types. Clement E. Chase remarked that the selection of type in such a case as the Kill van Kull crossing represents more a judgment from experience than a conclusion from calculations of cost.

Dr. D. B. Steinman showed an interesting group of recent views of the Sydney harbor bridge, under erection during the past five years and now approaching junction. Dr. Gustav Lindenthal made an instructive comparison of the Kill van Kull, Sydney and Hell Gate arches with respect to rise, loading, weight, width ratio and other factors. He questioned the wisdom of making the Kill van Kull arch so narrow, and sketched a modification of arrangement, with inclined trusses giving a broader base to the structure. He expressed the belief also that a fixed-end design would have proved better and esthetically more satisfying.

F. E. Schmitt, editor, *Engineering News-Record*, referred to the satisfactory design of sections of main members, which are solid plate assemblages, whereas the web members throughout are latticed; in view of the difficulty of developing full strength in latticed members and the waste of material involved it would be interesting to learn whether solid sections could not have been used for the web members, since this bridge should endure for an indefinite period and it is therefore desirable to avoid the weaknesses of lattice bars.

Mr. Ammann, replying to these and other discussions, said that the large side spans which a continuous bridge would have required rendered it uneconomical. The width of the bridge, while unusually small, is justified by the fact that the lateral distortion of the arch is so small as to increase the load stresses only by a negligible amount. The hangers of the bridge, Mr. Ammann said, were originally studied as eyebars, but recently the subject was reconsidered and wire rope hangers were concluded to be preferable and were adopted.

Highway Division

Two interesting papers on "Construction Management" were presented before a small audience in the highway division meeting. The small attendance, without doubt, was due to the concurrent Road Show at Atlantic City.

T. Warren Allen, chief, division of control, U. S. Bureau of Public Roads, reviewed the work the bureau has done for the past few years in checking the efficiency of contractors' operations and determining the cause of delays in the field. Although the findings of the bureau have been widely published in its magazine and in a book and have been presented at various conventions, Mr. Allen's talk was received with interest. Speaking of contractors' delays, Mr. Allen showed that on the average job the paver is working but 60 per cent and the power shovel but 62 per cent of the available time. Though

much of the delay is chargeable to the weather, the reports indicate that many delays are caused by carelessness or lack of foresight on the part of the contractor. Shortage of hauling equipment in both concrete and excavation is responsible for much serious loss of time. Knowledge of the causes of delays has helped many contractors, and the bureau is satisfied that its work has not been in vain.

For a period of three years the bureau has been making tests on mixing time and has found that a 45-second mix in a modern paver in good condition is long enough and that nothing is gained by demanding a mixing time longer than 60 seconds.

As an example of illogical management on the part of highway officials Mr. Allen cited the award of a contract for paving a stretch of road in the center of a long unimproved section, requiring the contractor to transport his materials over long stretches of poor roads and resulting in an improvement practically worthless until it had been joined to existing improved sections. On another contract the failure to award the bridge contracts along with the paving work required the paving contractor to resort to expensive and long detours to get his equipment and materials to various parts of his job.

A paper by Richard Hopkins, contractor, of Albany, N. Y., contained much advice for the highway contractor. Mr. Hopkins maintained that any contractor who gets more than 20 per cent of the work he bids for is a poor bidder; he is bidding below the market. Contractors should bid on occasional work during the progress of existing work, rather than waiting until near the completion of a job to rush out and bid on any job at any price just to keep working. Most contractors do too much work, according to Mr. Hopkins, producing an unhealthy strain on their financial structure and organization.

The selection, purchase and care of equipment were never so important to the contractor as at present in this day of mechanization of the construction job. This increased use of machinery has added a new member, and an important one, to the contractor's staff, the master mechanic. It is he who is charged with the operation and maintenance of the contractor's chief investment.

The program ended with a summary of the papers and discussions presented at the quarterly meetings last year on distribution of motor license fees and gasoline taxes. It brought out the fact that there is no prevailing opinion or practice. During the discussion an effort was made to have the highway division go on record as favoring a plan in which a certain portion of the funds will go to municipalities for use in streets related to rural highway systems, but the effort failed and the matter was referred to a committee. This committee will be appointed by the executive committee of the division, to gather additional facts and report to the executive committee by Sept. 1. The committee's report, along with the comment of the executive committee, whether favorable or not, will be presented at the next annual meeting.

Construction Division

Three illustrated talks on subway construction in New York City were presented before a well-attended meeting of the construction division. The talks covered widely differing types of construction. Herbert M. Hale, managing engineer, Marcus Contracting Company, New York, described the construction of the north section of the new Nassau St. subway, involving extensive use of special methods of underpinning buildings and other structures. This section is one of the most difficult ever encountered in New York. Miles I. Killmer, general superintendent, Mason & Hanger, Inc., New York, described the driving of the twin tubes under East River from Fulton St., New York, explaining the use of gravel packing to prevent land settlement on the shore sections of the tunnels. This method forces pea gravel into the space left by the tail of the shield as it moves forward. Several views were given showing the interesting construction of the Brooklyn Bridge Plaza station in Brooklyn being built between two shield-driven land sections of the tunnels.

Another type of subway construction, the more ordinary cut-and-cover sections, was described by J. H. C. Gregg, chief engineer, Oakdale Contracting Company, New York. Mr. Gregg presented several comparisons between modern construction and earlier methods used on the subways.

No other technical papers were presented at the meeting. The construction division is engaged in preparing a manual on the economic use of construction plant used on steel and concrete buildings, highways, hydro-electric installations and steel and concrete bridges, with a separate committee covering each class of work. The manual is expected to be published by the first of next year. The division has completed the preparation of a bibliography on construction plant, listing all the articles published in the past ten years in the technical press.

Sanitary Division

At a meeting of the sanitary engineering division announcement was made of the election of William H. Dittoe, of Youngstown, Ohio, as chairman of the executive committee for the ensuing term of office, and of Prof. Edward Bartow, of the University of Iowa, as the new committee member. The committee in charge of the award of the Rudolph Hering medal reported that during the past year there had been no paper on a sanitary engineering subject published in the *Transactions* of sufficient merit to warrant the award of the medal. Progress reports were presented by the chairmen of the committees on filtering materials and New Jersey sewage experiments.

The committee on friction of sludge in pipes reported its inability to complete the tests undertaken and requested that it be discharged. The hydraulic friction occasioned by the flow of sludge was found to be dependent upon the type of piping equipment used and the open- or closed-circuit condition of the piping system, as well as upon the usual hydraulic factors. The latest report of the committee was accepted by the division as a final report and the committee was discharged.

In order to prevent duplication of effort and unnecessary publication expenses, the committee on water-works requested that it be discharged. The members of this committee are all members of a similar committee of the American Water Works Association which is charged with exactly the same duties. The request of the committee was granted by the division. A resolution was passed by the division, however, requesting the executive committee to consider the appointment of a new water-works committee in order that the American Society of Civil Engineers might not completely relinquish its interest in water-works engineering.

Entertainment

As a change from the satirical sketches of engineering practice which have been features of the smokers at re-

cent annual meetings, three men outside of the engineering profession were invited to speak this year, each man to express his view of the engineering profession as seen by an outsider. Timothy Shea, New York, expressed the lawyer's view, George McAneny, former president of the borough of Manhattan, stated the views of the man in public office, and George B. McLaughlin gave those of the banker.

Trips to engineering work in progress in the metropolitan area were included in the program for Friday and Saturday. One was by ferry to see the work on the steel arch bridge under construction over Kill van Kull and then up to see the work of spinning the cables of the Hudson River bridge; the other was to see some of the subway work in Brooklyn. In both instances elaborate provisions had been made to aid the visitors in an understanding of the work in progress. At the close of the subway inspection trip the contractors, Mason & Hanger, entertained the party at luncheon served in their shaft house.

Regional Plan Association Maps Landing Fields Near Chicago

Utilizing 4½x6-in. portions of its ½-in. base map of the region, the Chicago Regional Planning Association has placed thereon the location of 34 airplane landing fields. In addition there is provided a large-scale map of each field and a statement which includes the following information: class (municipal, commercial or intermediate landing fields); position (latitude and longitude, altitude and distance from nearest city); description (size, shape, surface gradient, drainage, runways, etc.); obstructions (hangars, radio antennas, electric pole lines, trees, railroads, ditches, embankments, smokestacks, etc.); marking and identification; lighting (beacons, floodlights, spot lights, etc.); accommodations (hangars, supplies of gas and oil, repair shop, restaurant, clubhouse); communication facilities (telephone number); meteorological data (prevailing winds in summer and winter, fog, weather map on display). Finally, a small 7¼x10-in. general map locates the 31 municipal and commercial fields and three Department of Commerce fields on the main paved roads of the region.

Montevideo Builds Boulevard and Seawall Along River

MONTEVIDEO, Uruguay, as a part of its extensive city improvement program, is reconstructing its waterfront by building a boulevard and concrete seawall along the Rio de la Plata for a distance of about 2½ miles. When it is completed, this project will greatly enhance the appearance of this section of the city by removing a large number of the old waterfront structures and encouraging the improvement of the remainder.

The seawall foundation is made up of two courses of large precast concrete blocks placed on a mat of burlap

SEAWALL CONSTRUCTION FOR WATERFRONT IMPROVEMENT IN MONTEVIDEO

bags filled with concrete. A facing of stone masonry will be applied to give the wall a pleasing appearance.

Two circular holes are cast in each of the foundation blocks, and the courses are arranged so as to bring the holes in the upper and lower blocks into coincidence. The courses are keyed together by filling the holes with concrete reinforced with vertical bars, the bars extending up past the top of the upper block far enough to form an anchorage for the wall.

F. H. Schmidt has the contract for constructing the west section of wall, and Sudriers Hnos. has the contract for the east end. Each contract amounts to about one million dollars. Luis Giorgi is the engineer in charge.

FORTY-TON FOUNDATION BLOCKS AT CASTING PLANT

Equipment and Materials at the 1930 Road Show

Improvements at Exposition in Atlantic City Highly Individualistic With Few Marked Trends Discernible—Scope of Exhibits Gives No Support to Business Depression Bogey

Engineering News-Record Staff Report

THE 1930 Road Show—officially the 27th Annual Exposition of the American Road Builders' Association—was held in Atlantic City, N. J., Jan. 13-17, with 360 exhibitors showing their 1930 offerings of road-building equipment and materials. There were also seventeen exhibits maintained by publications serving the highway field. Although the total number of exhibits represented about 30 fewer exhibitors than were present at last year's show in Cleveland, no reduction in the magnitude of the display nor in the interest shown by visitors was apparent. The two floors of the new auditorium were filled to capacity and the stage and several rooms backstage were commandeered for exhibit space. Some individual exhibits were larger than at any previous show.

Trends in equipment design begun last year or earlier—cut gears, oil-tight housings, alloy steels, larger concrete mixer openings, anti-friction bearings, truck mixers and bodies for ready-mixed concrete, crawler wagons, weight proportioning—continued, but few wholly new ones could be discerned. Two that might be mentioned are the increasing use of bulk cement and the increased number of prepared asphalts offered. Several individual manufacturers, on the other hand, showed innovations which were very important.

Optimism concerning 1930 business was everywhere noticeable. Before the show ended, sales, which are more tangible and useful than optimism, were reported in considerable volume. Some of these reports were so remarkable, in fact, that the optimism may have fostered exaggeration. Nevertheless, the show was in all respects a success and can take its place on a par with the impressive exhibitions held in Chicago and Cleveland during the past five years.

Aside from the road equipment and materials, there were, as usual, numerous special exhibits of photographs, specifications and educational data. The most pretentious of these exhibits was maintained by the Bureau of Public Roads, showing the important results that have come from its soil investigations. Other exhibits included American Association of State Highway Officials, Province of Quebec, Alaska, Porto Rico, Cuba, Dominican Republic, Guatemala, Mexico, Costa Rica, Salvador, Nebraska Department of Public Works, New Jersey Department of Highways, South Carolina State Highway Commission, Virginia State Highway Commission and Association of Chosen Freeholders of New Jersey.

An innovation was recorded by the inclusion of a group of airport exhibits in which were represented some 30 manufacturers whose equipment and materials are adaptable to airport construction. Space for these exhibits was donated by the American Road Builders' Association. Also in this exhibit were two airport models donated by the Curtiss Manufacturing Company and the Fairchild Airplane Manufacturing Company.

The following report of the Road Show is not all-inclusive so far as individual pieces of equipment are concerned. With some of the exhibits containing between fifteen and twenty pieces of equipment, a complete description of each obviously is impossible. However, a sincere attempt has been made to list every exhibit and to point out some of the features of the more important units of equipment shown.

Grade Preparation

Power Shovels, Cranes and Buckets—There were no changes in power shovel or crane design which could be grouped and regarded as general trends, unless the fact that not a single steam machine was shown can be considered indicative of the final supremacy of gasoline and diesel power. More manufacturers offered diesel engines as optional equipment than ever before, and several of them are pushing diesel power more than gasoline. On the whole, however, changes in power shovels were highly individualistic. The Koehring division of National Equipment Corporation introduced an unusual advance in design by inclosing all gears in oil-tight housings on its new 1-yd. model 401 shovel. In addition, the operating machinery shafts are mounted on roller or ball bearings the same as the company's older 1¼-yd. shovel, which also was exhibited. The appearance of the model 401 is clean-cut, since the only gears visible are the

HIGHWAY EQUIPMENT ON THE MAIN FLOOR OF THE ATLANTIC CITY AUDITORIUM

turntable gear and swing pinion. Unusually fast operation is claimed for the new shovel. It is powered by a six-cylinder Wisconsin 100-hp. gasoline engine. Another innovation is the use of shutters on the radiator.

The Harnischfeger Sales Corporation exhibited a new 1-yd. diesel shovel utilizing a four-cylinder Atlas-Imperial engine. This shovel is one of a line of seven new excavators just announced by this company and available with either gasoline or diesel power. All of the machines incorporate the company's unit cast-steel construction throughout and feature two-speed tractions. A new "fish-belly" cross-section boom and a new dipper trip are also additions. The line varies in capacity from 1 up to 3½ cu.yd. The company's standard model 300-A dragline excavator with 35-ft. boom and ½-yd. bucket was also exhibited.

An outstanding innovation was presented by the Western Manufacturing Company, of Detroit, in its new "ace of spades" ⅜-yd. full-revolving gasoline shovel which utilizes a Lockheed hydraulic control, similar to that used for automobile brakes. This control permits the operator to handle all shovel motions with a single lever—it is called the "joystick" control. Brakes are applied by foot pedals, and two hand levers control the crawlers. A three-lever manual-control system is optional equipment. A further innovation is a telescopic boom which may be varied in length from 7 to 30 ft. Another feature of this shovel is that the hoist, swing and crowd mechanism is mounted on a heavy cast-steel frame with center bearings only, permitting removal of either clutch or drum mechanism without disturbing the others. A Hercules six-cylinder 55-hp. engine is the power plant.

The Thew Shovel Company showed a new and heavier 1¼-1½ yd. shovel, designated as model 75B. The company's excavators, models 45 and 55, were shown as dragline and crane respectively. The outstanding feature of new equipment in this exhibit was a new type of crawler in which the standard single end-rollers are replaced by equalizer rocker arms mounted on the end axles. Each rocker arm carries both a large end-roller and a small intermediate load-carrying roller. The mounting increases the over-all length of the crawlers, reducing ground pressures from 15 to 25 per cent and in addition eliminates the tendency of the crawlers to dig in under a forward tipping load. As an integral part of the Thew exhibit, the Universal Crane Company showed a 7½-ton truck crane on a Mack chassis with detachable crawler treads and a Universal 35 crane with a ½-yd. back-digger bucket.

The Moore Speedcrane exhibited by the Manitowoc Engineering Works in 1⅛-yd. size has been entirely redesigned. It included a new shovel crowd which is independent of the hoisting action. Automotive principles of construction are utilized and a new extended crawler reduces pressures to about 6.8 lb. per square foot. The Byers Machine Company, in addition to its ½- and ¾-yd. shovels and cranes, showed a new 1-yd. shovel featuring direct power drive to the drum, a worm-drive boom hoist and a reversible cable crowd. An 85-hp. engine comprises the power plant.

The Keystone Driller Company showed a new model 17, ¾-yd., 25-ton shovel in a full revolving design, mounted on full crawlers. The new model was equipped with the company's skimmer scoop attachment. The model 4 half-swing machine was also exhibited. The Speeder Machinery Company showed its ½-yd. shovel featuring a 40 per cent increase in power and a 20 per cent increase in speed. The company also exhibited a new 1¼-yd. shovel of unusually massive construction, powered by a four-cylinder, 110-hp. gasoline engine. Other features are two working speeds on drum, swing and travel; the company's patented independent cable crowd and its double outside band clutch; an unusually high ground clearance of 17 in.; and a power boom hoist with self-locking worm drive.

The Northwest Engineering Company maintained a comprehensive exhibit which included gasoline-powered machines in its models 3, 4, 5, 6 and 7. They were equipped variously as power shovels, draglines and gooseneck pull shovels. Prominent space in the Northwest exhibit was accorded its new oil engine, which is not a diesel but an engine with the usual ignition system of a gas engine but which uses lower priced fuel. The Bucyrus-Erie Company exhibited a 1-cu.yd. gas-plus-air shovel together with its ½-yd. and ¾-yd. shovels, available either with gasoline or diesel power. A diesel-plus-air shovel was announced for the first time. The Link-Belt Company exhibited its 1-cu.yd. gas shovel, one feature of which is that both the driving and steering mechanisms are inclosed in oil-tight housings. The Industrial - Brownhoist Corporation showed a crawler crane with a 35-ft. boom as well as ½-yd. shovel-boom assembly. The General Excavator Company exhibited its ½-yd. machine with shovel assembly. The American Hoist & Derrick Company, the Marion Steam Shovel Company, the Osgood Company and the Ohio Power Shovel Company also had exhibits of their excavators. In addition the latter company included a 92-hp. diesel engine and a Page drag-shovel attachment for its Lima 101 machine in its exhibit.

Bay City Shovels, Inc., exhibited no new models, but announced the availability of diesel power for its 26-ton model R and its 14½-ton model K shovels. Also, its 10-ton three-quarter revolving tractor-shovel was shown. The Orton Crane & Shovel Company exhibited a model A 1⅛-yd. shovel as the "first small-capacity excavator to be equipped with a six-cylinder engine." A feature of this machine is a riveted structural steel frame with all joints reinforced by arc welding. A new ⅜-cu. yd. crawler shovel built around a McCormick-Deering power plant was a new product of the Ohio Locomotive Crane Company. The Meade-Morrison Manufacturing Company showed its ½-⅝ yd. shovel, the Insley Manufacturing Company its type R shovel and type C skimmer, and the Universal Power Shovel Company showed two small new shovels of 10- and 12-cu.ft. capacity respectively. Waukesha power is used and all of the operating mechanism is inclosed and running in oil. The Buckeye Traction Ditcher Company exhibited its crawler-mounted utility crane with variable length boom.

There were about half a dozen exhibits of excavators built around tractors. The Hughes-Keenan Company exhibited a "Roustabout" 1-ton crane with double drum and overhead counterweight. Both a McCormick-Deering tractor and a United tractor were exhibited with this assembly. The Trackson Company and the Wm. Blair Manufacturing Company showed scoop-type shovels mounted on a McCormick-Deering tractor, the crowd of the shovel being supplied by running the tractor into the material to be exca-

From a Road Show Notebook

No indication of an imminent business depression could be found at the show. Most of the exhibitors had enjoyed record business in 1929 and are expecting 1930 to be at least an equal year.

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Cut-away sections of engines and pumps tell more at a glance than will be learned from an hour's study of blueprints. Besides, visitors are fascinated by the cam and valve actions. There were numerous such exhibits at the show.

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Success with its inclosed-gear paving mixer, introduced last year, was a factor in the Koehring Company's determination to build a power shovel along the same lines. The new 1-yd. model 401 shovel, displayed at the show, has every gear inclosed and running in oil. This machine represents one answer to the question, What's new at the Road Show?

* * *

The Armco Culvert Manufacturers' Association devoted part of its exhibit to a demonstration of a method for jacking its corrugated pipe through a fill. It is reported that some members of the association are selling the pipe installed, when the jacking method can be used advantageously.

* * *

Power take-off drives enter the elevating grader field. Both Caterpillar and Stroud showed machines operating from a drive shaft connected to the tractor. Inequalities of ground and the shifting tendency of sand do not affect the efficiency of this drive as they are said to affect the drives from geared rear wheels.

vated. N. P. Nelson Iron Works, Inc., exhibited a tractor-crane arranged for operation with a ¾-yd. Hayward bucket, and W-K-M Co., Inc., showed a side boom mounted on a Caterpillar 60 with a Williams ⅝-yd. bucket. Frederick H. Poor, Inc., exhibited its Loadmaster crane built around a McCormick-Deering tractor and featuring a stabilizing device on the front axle which enables the crane to handle loads up to 3,000 lb. All of the crane's superstructure and operating mechanism is mounted over the hood ahead of the tractor driver and does not interfere with utilizing the tractor as a pulling unit.

In the field of automatic buckets, the Erie Steel Construction Company presented a new "multi-power" clamshell, the design of which represents a combination of the block-and-tackle and lever-arm principles. The combination is said to result in both more power and more speed. Inasmuch as the bucket can be rigged with 2, 3, 4, 5, or 6 parts of line it can be adjusted to suit the type of digging encountered. In addition it is built with an unusually low headroom which reduces the amount of line to overhaul in opening and closing the bucket and thus speeds up operation. A bucket utilizing the same principles — the new Champion excavator of G. H. Williams Company—featuring in addition a narrow head construction was an important exhibit in this group. Other clamshell buckets were exhibited by the Owen Bucket Company, the Orton Crane & Shovel Company, Blaw-Knox, the Geo. Haiss Manufacturing Company, Lakewood Engineering Co. and Meade-Morrison Manufacturing Company. The Hayward Company also exhibited orange-peel buckets in addition to its clamshell buckets, and the Union Iron Works showed a bottom-dump bucket and models of skips of various designs. Another exhibit in the power shovel field was a power trip exhibited by M. P. McCaffrey, of Los Angeles.

Grading Machinery—In the field of grading equipment the Road Show recorded a large increase in the number of wheel scrapers of the type that dig, transport, dump and spread the material. The Baker Manufacturing Company, a pioneer with this machine, showed its self-loading Baker-Maney scrapers featuring the use of a double cutting edge. In addition this company exhibited rotary scrapers, bulldozers, snowplows and a road-maintainer drag mounted on rubber tires for rapid transport. An unusually large machine of the wheel-scraper type in which the pan is operated by the tractor power was exhibited by the Highway Trailer Company in a 5½-cu.yd. size. The scraper pan is carried on an axle resting in a channel steel frame which is hooked to the tractor by a drawbar and pin. Power is taken from the tractor to the scraper transmission by a combination universal joint and drive shaft, this power being used to operate an endless chain of scrapers which drag the material from the cutting edge to the back of the pan. In dumping, the tractor driver pulls a rope which releases the latch of a door in the back of the pan. This door levels the dumped material in passing over it.

The Atlas Scraper Company exhibited a bowl-shaped scraper in which the action of the bowl's cutting edge is supplemented by auxiliary plows on either side. Because of these plows it is said that a scarifier is seldom necessary. The wheels of this scraper follow in the furrows cut by the plows, lowering the cutting blade of the bowl and permitting a relatively deep cut. This grader-scraper is made in capacities of 30 to 75 cu.ft. and it will make cuts from 6 to 10 ft. wide, according to the model used. All operations are by means of levers actuated by ropes which can be conveniently reached by the tractor driver. The American Tractor Equipment Company exhibited a hydraulic dirt mover, similar to a wheel scraper except that it has no bowl, but instead drags the dirt which is excavated by its cutting edge. This cutting edge is held to the ground by means of counterweighting supplied by the wheels, which are raised off of the ground by means of a hydraulic cylinder. When the scraper is not in operation these wheels are dropped to the ground, automatically lifting the blade and placing the equipment in position for rapid mobility. A scarifier built on the same principle—that is, utilizing the wheels as counterweights—also was shown. Both of these are new pieces of equipment in the East, although the dirt mover has been used for some time on the Pacific Coast. Operation is entirely from the tractor driver's seat, and consists merely in operating a three-way valve which controls the hydraulic cylinder.

Another wheel scraper, shown by the Shaw Excavator & Tool Company, was a 4-yd. model on which the pan was controlled by a cable passing over an A-frame superstructure on the scraper and wound on a small hoist at the rear of the tractor. As the pan is loaded the cable is wound up, lifting the front of the bowl from the ground to transporting position. Dumping is accomplished by a rear door in the pan. The automatic wheel scraper of the Euclid Crane & Hoist Company was improved over previous models by utilization of a new cast-steel drawbar. In the Blaw-Knox exhibit a Ball wagon grader, in effect a tandem wheel scraper carrying two pans on a single frame, was shown. The W. A. Riddell Company exhibited a new 2-yd. wheel scoop in which the pan is held in cutting position by a lever and clutch control and snaps back to carrying position by virtue of heavy coil springs.

The Perry rotary fresno was shown by United Tractor & Equipment Company, while other revolving fresnos were shown by the General Wheelbarrow Company and the Killifer Manufacturing Corportion. The latter company also showed a piece of equipment known as a mole drainage machine. With this machine a bullet-shaped weight is towed behind a plow blade inserted several feet below the ground surface. The bullet-shaped weight rounds out a conduit and thus a circular drain is automatically constructed.

In the field of road graders, motor-operated units showed several improvements. The Austin-Western Road Machinery Company extended its dual-drive principle to a new small unit for township work. Its larger unit also was made heavier than last year's model and was powered by a six-cylinder engine built into the frame; last year's model was built around a tractor. The company also exhibited a 12-ft. leaning wheel grader. J. D. Adams & Company improved their motor grader by the use of a Ross cam-and-lever steering mechanism. The company's leaning wheel grader also was exhibited. Good Roads

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From a Road Show Notebook

Devices to make life easier for the operator increase in number annually. J. D. Adams showed a Ross cam and lever steering gear on its motor grader, making it comparable to the best motor trucks. The Koehring Company's Dumptor tractor-truck is equipped with a spring seat mounted on a hydraulic pedestal. The Western Manufacturing Company operates the clutches of its new power shovel on the hydraulic brake principle. More comfort for the operator and more output for the contractor.

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Motor rollers resembled steam calliopes in their fancy colors and trim. Incidentally, only one steam roller graced the show. Buffalo Springfield, which pioneered in that field, showed it along with its numerous gas models.

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The beach at Atlantic City provided an excellent stage for field demonstrations, with the spectators on the Boardwalk. Moore Trench Machine capitalized on the location with an installation of its well point system and maintained an excavation dug in the sand to 20 ft. below sea level, in an absolutely dry condition.

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Demountable crawlers for motor trucks also held a field day on the beach. Imprints of the Tructor Corporation's crawlers could be found in every soft spot.

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When highway engineers are considering specification changes that will affect equipment design, the manufacturer of road-building machines should not be forgotten. One exhibitor points out that such changes are better if announced in the fall before manufacturers have made commitments for materials and started manufacturing for stock. Specification changes in January or February often result in a considerable loss for the manufacturer, who finds himself stocked with obsolete machines.

Machinery Company, Inc., supplemented its Autograder, introduced last year, by a larger machine designated as a Dreadnaught power grader. The new grader also utilizes a built-in power plant—a 25-hp. Red Seal Continental engine. As in the Autograder, the engine is installed in the frame at the rear of the grader and power is applied to the road through crawlers 13 in. wide and 72 in. long. All lift-gear housings are heavy semi-steel castings, machined to be oil tight and dust proof and inclose a set of spur gears ahead of the worm and worm gear, thus giving a double reduction or a ratio of 144 to 1. The weight of the machine without scarifier is 13,200 lb. The Galion Iron Works & Manufacturing Company exhibited a complete line of motor and blade graders equipped with its E-Z lift blade mechanism and patented skew axle and leaning wheel arrangement. Motor graders were shown built around McCormick-Deering and Cletrac tractors. Several motor graders built around United power units were shown with both crawler and wheel traction by the United Tractor & Equipment Company. Foote Bros. Gear & Machine Company exhibited the Stockland line of horse-drawn patrol graders and motor graders. The Stockland heavy 50-10 and 80-12 models were also shown, as were the small Whippet graders built around 10- to 30-hp. tractors. The Rome Manufacturing Company exhibited its line of tractor-drawn graders, and the Ryan Manufacturing Corporation, in addition to its tractor-hauled graders, showed a new model of its power-operated grading machine, which, although it is pulled by a tractor, incorporates its own 8-hp. engine by means of which the frame, blade and wheels are adjusted for a wide range of grading or ditch-sloping work. The grader is completely equipped with Timken bearings and Alemite oiling system.

A new innovation in the field of elevating graders was the utilization of tractor power for the moving belt. The Caterpillar Tractor Company showed its 42-in. elevating grader operating through a drive shaft from the power take-off of a Caterpillar 60 tractor. Gearing on the rear wheels, which was formerly used to motivate the endless belt, has been eliminated in favor of this power take-off. Other new features are the use of an extension rear axle, ball bearings and new and heavier supports for the underside of the belt. Caterpillar also showed a 12-ft. grade blader with Timken roller bearings and bronze gears and a new road maintainer machine with blades adjustable from the tractor driver's seat. The Little Red Wagon Company showed a model of its new 42-in. Stroud elevating grader, which also utilizes the tractor power take-off for operation, but in addition retains the gears on the rear wheels for use in emergencies. A foot-operated gong is placed beneath the platform so that the elevating grader operator can attract the attention of the tractor driver when necessary. Twisted link coil-proof chains are a new feature for all controls on this grader.

Motor maintenance graders were exhibited by the Wehr Company, the United Tractor & Equipment Corporation, and the W. A. Riddell Company. On the rear wheels on one of its graders the Wehr Company showed its new all-purpose wheels with disappearing lugs. When rubber-tired traction is desired, these lugs lie flat between the dual tires. When a rough tread is required, they are pulled up between the dual tires and turned crosswise, springs holding them in position. This all-purpose wheel was also shown on several exhibits of the United Tractor & Equipment Company. The W. A. Riddell Company, on its power graders, emphasized the interchangeability of scarifier, snowplow and bulldozer attachments. It also showed a new motor grader which it designated as a "pull type," in which the operator stands near the front of the machine with the power plant and the grader blade behind him.

Two large-sized bulldozers whose frames completely inclose their crawler-tractor power plants were exhibited by Niess & Company and the Essex Engine & Machine Corporation. The Niess bulldozer is built around a Monarch tractor, the bulldozer blade being operated from the tractor power take-off through links. The Essex bulldozer is built around a Cletrac tractor and utilizes a hydraulically operated blade controlled by a cylinder on each side of the tractor. A feature of this machine is that the sub-frame is designed so that the dead axle of the tractor rather than the crawler frame takes the thrusts and strains.

Maintenance scrapers for underbody attachment to motor trucks were exhibited by the Willett Manufacturing Company, the Root Spring Scraper Company and the Pneu-hydro Road Machinery Company. The Willett and Pneu-hydro scrapers are hydraulic operated. The Root Spring Scraper Company also exhibited large V snowplows and also a straight blade snowplow for underbody attachment. The Wiard Plow Company showed a new grade ripper or scarifier mounted on two wheels for towing, in addition to a new revolving scraper and its line of plows. The Shunk Manufacturing Company exhibited grader and drag blades as well as scarifier teeth. Another exhibit that belongs in this classification was the model of a shoulder-finishing machine shown by the Moritz-Bennett Corporation. This machine, which runs on the finished slab, carries a blade on an adjustable arm which trims the shoulder to any desired width and slope.

Road Rollers—A newcomer among the road roller exhibitors was the Hercules Company, a subsidiary of the Osgood Company, which exhibited its road roller announced last summer. This roller is built of steel throughout, designed to automotive standards, and is powered by a six-cylinder engine with speeds both forward and reverse of 1.5, 3.2 and 5.5 miles per hour. The latter speed is designed to make the roller suitable for transportation between jobs and for tractor service. The Buffalo-Springfield Roller Company had the distinction of exhibiting the only steam machine at the show, an 8-ton tandem roller. In addition this company exhibited its 17-ton motor-driven special maintenance roller, a 10-ton standard three-wheel roller with scarifier and grading blades and a 10-ton motor tandem. The Ames Iron Works contributed an innovation on its 5-ton, six-cylinder motor roller by installing a scraper blade ahead of the rear wheels. This scraper attachment is adjusted from the roller operator's platform and is turned flat when not in use, giving ample

From a Road Show Notebook

Skip weighing systems for small building mixers extend weight proportioning to the smaller job such as bridge piers and bridge and building floors. The "Weigh-Mix" system was shown by T. L. Smith and the Winslow scale by Jaeger and Chain Belt. Such weighing systems require changes in the mounting of the skip that will permit it to be detached from the mixer while it rests on the platform of the scales.

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There are at least 900 diesel-powered excavators in use today. The Atlas-Imperial Engine Company has sold that many diesels for power shovel and crane service.

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More Pacific Coast manufacturers were present than at former Road Shows—and they showed Eastern road builders some new equipment. The American Tractor Equipment Company, for instance, showed both a trailer scarifier and a dirt mover on which the wheels, ordinarily used for mobility, are raised off the ground by means of a hydraulic cylinder, to provide counterweight for the scarifying teeth and the digging blade of the dirt mover. The Atlas Scraper Company, another Coast representative, showed a grader-scraper similar in appearance to a rotary fresno but mounted on wheels and loaded not only by its own bowl grader blade but by auxiliary plows on either side. Atlas diesel engines and Caterpillar tractors also come from west of the Sierras.

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Methods of water control on mixers are not by any means standardized. High-pressure, low-pressure, no-pressure and siphon systems can be found. All of them are claimed to be accurate to the ounce.

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Fuller-Kinyon conveying systems were designed originally for handling powdered coal. Now they are also a basic piece of equipment in all cement-manufacturing plants. It requires no change to adapt them to bulk handling of cement on the job. Essentially, the system involves a screw conveyor which starts the material through the line, and a compressor which furnishes air to float the material through the supply pipe after it leaves the screw pump. The Hercules Cement Corporation showed a model of its patented bulk cement railroad car fitted with attachments for Fuller-Kinyon pumps for unloading.

ground clearance. Other roller exhibitors were Galion Iron Works & Manufacturing Company, both tandem and three-wheel rollers; the Austin-Western Road Machinery Company, with both large and small rollers; the Huber Manufacturing Company, with four-cylinder, 5- and 10-ton motor rollers with scarifiers; the Wehr Company, with a 5-ton roller, and the United Tractor & Equipment Company.

Air Equipment—Portable compressors, pneumatic drills, riveting hammers and air receivers were shown by seven exhibits. The Davey Compressor Company's machine, an air-cooled compressor of 142 cu.ft. per minute capacity, was shown mounted on both a Caterpillar 20 tractor and a McCormick-Deering 10-20 tractor. This machine is light in weight and small, and of the two-cylinder vertical type, capable of developing 25 to 80 lb. pressure. Buhl Company showed a 110-cu.ft. compressor on a highway trailer and a 220-cu.ft. machine on steel wheels. A new model mounted on trucks and designated as model FJ 36 is powered with a four-cylinder Fuller-Johnson engine; a two-cylinder engine has been used on this unit heretofore. The feature of the National Brake & Electric Company's exhibit was its 240-cu.ft. V-type compressor mounted on a rubber-tired trailer. This company also showed a single-cylinder motor-driven compressor and a 185-ft. portable compressor, of the six-cylinder V-type, driven by a four-cylinder engine. Schramm, Inc., exhibited the largest portable compressor at the show, a 360-cu.ft. four-cylinder model. In addition to this it showed a two-cylinder 120-cu.ft. machine and a line of drills and air receivers.

A new machine in the compressor field shown by the Homelite Corporation used a 1½-hp. air-cooled engine and weighed 85 lb. Its capacity is 6 cu.ft. per minute. The Metalweld-Worthington exhibit included 110-cu.ft. and 330-cu.ft. machines. The latter was on solid rubber tires. The features of this line of compressors are feather valves, full force-feed lubrication on both motor and compressor, and improvements to assure maximum output at low temperatures. A 120-cu.ft. two-cylinder compressor powered by a Hercules engine was exhibited by the O.K. Clutch & Machinery Company. The Fuller Company included rotary air and gas compressors in its exhibit of equipment for use with the Fuller-Kinyon system of bulk cement handling.

Culverts—Corrugated flexible culverts were shown by Toncan Culvert Manufacturers' Association and the Armco Culvert Manufacturers' Association. The former exhibited perforated drains, half-round culverts and full-round culverts of copper molybdenum iron. They also exhibited a new Tyton sluice gate, a flap-type of drainage gate. In the Armco exhibit the company's paved invert culverts occupied prominent space. In addition there were numerous sections of this company's pure iron corrugated culverts, and samples of various fittings. Part of the exhibit was devoted to motion pictures and demonstrations of a method for jacking culverts through fills. The American Casting Company exhibited corrugated cast-iron pipe which has been improved and strengthened by widening the corrugations. These corrugations are spiral so that any number of lengths of pipe can be screwed together. The company's lock-joint bell-and-spigot cast-iron pipe also was shown. Ric-Wil Company exhibited a cradle-base tile sewer drain and cast-iron culvert pipes and sewer joint compounds.

Trenchers—New machines in the trencher field were contributed by the Cleveland Trencher Company and the Buckeye Traction Ditcher Company. In addition to its Baby-digger wheel-type trencher and its Pioneer ladder-type trencher with pivoted conveyor, the Cleveland Trencher Company showed a new tamper backfiller, mounted on crawlers. The tamping arm is on a pivot and can be swung to either side, although it ordinarily operates directly ahead of the machine, which straddles the ditch. It strikes 45 blows per minute and has a dropping power of 380 ft.-lb. The new Buckeye wheel-type trencher has a maximum digging depth of 5½ ft. and is constructed along automotive lines with inclosed digging-wheel drive and hoist gears and with a gear-shift digging-traction transmission. Round or square bottom buckets are available for the digging wheels. Roller and ball bearings are used throughout. This company also showed its small model F backfiller with a boom adjustable from 12 to 20 ft. The vertical boom ditcher of the Barber-Greene Company was shown in operation. The Parsons Company, a division of the National Equipment Corporation, on its model 25 trench excavator features two speeds on every drive, all drives inclosed in oil-tight housings and Armco manganese chains. The Geo. Haiss Manufacturing Company exhibited its bucket excavator digging up to 4 ft. deep and 8 ft. wide, equipped with a belt conveyor at its discharge end, to assist in truck loading or disposing of soil at some distance from the trench. The Austin Machinery Corporation exhibited its Public Service ditcher and backfiller, the Industrial Brownhoist Corporation its crawler ditcher and the Harnischfeger Sales Corporation a backfiller utilizing the unit cast-steel construction used on this company's large shovels and cranes.

From a Road Show Notebook

Several years ago a gas shovel with hydraulically operated clutches was introduced, but it did not appear at subsequent shows. This year the Western Manufacturing Company, of Detroit, presented a machine similar in principle with clutches operated by the hydraulic apparatus developed by Lockheed for automobile and truck brakes. Ease and flexibility of operation are the goals sought. In the Bucyrus-Erie gas-plus-air shovel the same problem has been attacked by utilizing direct-connected air engines for hoist and crowd.

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Ditch digging and backfilling have been mechanized for some time. Now the Cleveland Trencher Company offers a gas-engine driven tamping machine combined with a backfiller.

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The Amiesite Asphalt Company offers rubbered asphalt, a mixture of aggregate, asphalt and milk of rubber, for pavements, describing it as a material which indefinitely retains its compressibility and is not subject to any detrimental effect by extreme temperatures. Pavements of similar material laid in France over twenty years ago have required no maintenance and are still in excellent condition, according to reports.

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The Caterpillar Tractor Company, including the newly acquired Russel Grader Company, enjoyed a phenomenal increase in sales in 1929. Representatives at the exhibit said 1930 should be even better.

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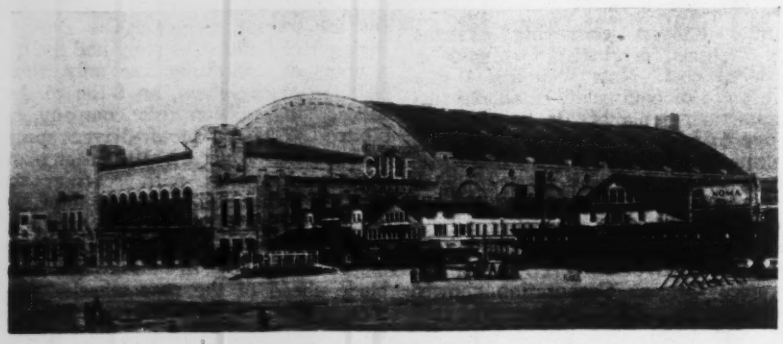
The new 80-60 crawler tractor of the Cleveland Tractor Company strikes a new note with its streamline effect, secured by placing the gasoline tank crosswise on the frame at the dashboard and flaring the engine hood from the radiator. Previous models placed the tank lengthwise on the machine on a platform over the crawlers.



THE ATLANTIC CITY AUDITORIUM AS SEEN FROM THE BEACH

NEXT WEEK

Conclusion of report on equipment at Road Show.

News of the Week

Saluda River Survey Completed

A survey of the Saluda River in South Carolina, in reference to the problems of flood control, navigation and water-power development, has been completed in five months. A similar survey has been started on the Congaree River. These are steps in the general survey of the tributaries of the Santee River.

According to Charles G. Benson, chief field engineer in the U. S. engineering department at Charleston, S. C., if the surveys show the plan to be warranted, a series of dams will be built on the Santee River tributaries to control the flow and at the same time make water power available.

Seattle to Receive Bids on Power Equipment

Bids will be received in the near future by the Seattle board of public works for furnishing machinery and equipment for two generating units to be installed in a power house below the Diablo dam, part of the city of Seattle's hydro-electric development project on the Skagit River. The installation will cost approximately $2,000,000. Each of the two units is estimated to cost $700,000, and the remaining $600,000 will be spent in the construction and equipment of the power house. Each main unit will consist of a generator of 60,000-kva. capacity at 90 per cent power factor. They are to be vertical units driven by reaction-type waterwheels. Auxiliary equipment includes necessary exciters, valves, governors and transformers. Plans for the installation were prepared by the city engineering department under J. D. Barkhuff, city engineer, in collaboration with J. D. Ross, superintendent of the municipal lighting department.

Railroad Branch Construction Authorized for Northwest

Construction of two railroad branch lines penetrating a heavily timbered district in northwestern Washington has been authorized by the Interstate Commerce Commission. The Northern Pacific Railway and the Oregon-Washington Railroad & Navigation Company will build a branch line, 67 miles long, running north from Aloha on the Northern Pacific, and the Port Angeles Western Railroad will run a 24-mile extension south from Forks. The two extensions have their extremities very close together near Spruce. The initial cost of construction of the Northern Pacific line is estimated at $6,421,339 and that of the Port Angeles Western extension at $1,035,511.

Road Builders Elect Van Duzer President at Annual Convention

THE selection of William A. Van Duzer, of Harrisburg, assistant chief engineer of the Pennsylvania department of highways, as president of the American Road Builders' Association for the ensuing year was formally ratified Jan. 17 at the Atlantic City meeting of the association. Mr. Van Duzer and the other officers nominated for the new year will be installed at the Washington conference in May.

W. A. VAN DUZER

Mr. Van Duzer has been engaged in road building of one kind or another since he was sixteen years of age. At that time he left school to carry surveyor's instruments for a New York Central Railroad construction superintendent. In the years that followed, he became closely associated with ranking officials of the railroad company and was connected with many roadbed building programs of the New York Central in the State of Pennsylvania. In 1912 Mr. Van Duzer resigned his position with the railroad to become associated with the Pennsylvania State Highway Department as maintenance engineer. In 1925 he was made assistant chief engineer and has held that position ever since. Identified with the American Road Builders' Association practically since it was formed, Mr. Van Duzer has served as a director of the organization for the last five years. In 1927 he was elected vice-president of the northeastern district and was re-elected to the office in 1928 and 1929.

Other officers chosen at the convention are: vice-presidents, J. R. Draney, Natural Rock Asphalt Corporation, Louisville, Ky.; Henry G. Shirley, state highway commissioner, Richmond, Va.; S. F. Beatty, president, Austin-Western Road Machinery Company, Chicago, Ill. For treasurer the association named James H. MacDonald, consulting road and paving expert, New Haven, Conn. Mr. MacDonald is a past-president of the association and was one of its founders. C. E. Myers, Philadelphia director of transit, was elected president of the city officials' division. In the county officials' division, Stanley Abel, supervisor, Kern County, California, was elected president. M. A. Corroalles, of Cuba, engineer in charge of the $76,000,000 central highway project in that country, was chosen to succeed Octavio Dubois, president of the Mexican Highway Commission, as president of the Pan American division.

Bids Called For on Bridges for Mount Vernon Memorial Road

Bids covering the bridge work on the Mount Vernon Memorial Highway, the 14-mile Potomac River boulevard now being built to connect Washington, D.C., with the home of George Washington, will be received Feb. 20 by the Bureau of Public Roads of the U. S. Department of Agriculture. The work includes twelve structures divided into two groups. Bids will be received separately on each group and on the work as a whole. The bridges will consist of stone-faced, reinforced-concrete arches, using native stone laid in random bond.

Kentucky Accepts Bids for Bridge Bonds

The state highway commission of Kentucky on Jan. 8 accepted the joint bid of the Stranahan & Harris Company, of Toledo, C. W. McNear & Company, of Chicago, and Stifel-Nicolaus & Company, of Chicago, for approximately $11,000,000 worth of bonds to be sold in order to obtain funds for the acquirement or construction of seventeen bridges. As soon as the bridges have paid for themselves they are to be made toll-free. The joint bid offered amounts ranging from $900.10 to $903.10 for each $1,000 bond. H. P. Palmore, state highway engineer, said that advertisements calling for bids on the work will be published shortly.

The seventeen bridges are grouped into thirteen projects, and the bond issue corresponding to each is as follows: Cumberland River bridge at Burnside and the Ohio River bridge at Maysville, $2,013,000; Green River bridge at Rio and the Green River

bridge at Munfordville, $283,000; Kentucky River bridge at Boonesboro, $308,000; Kentucky River bridge at Clay's Ferry, $205,000; Kentucky River bridge at Tyrone, $485,000; Green River bridge at Spottsville and the Cumberland River bridge at Canton, $867,000; Tennessee River bridge at Eggner's Ferry, $878,000; Ohio River bridge at Henderson, $1,807,000; Tennessee River bridge at Paducah, $887,000; Ohio River bridge at Carrollton and the Kentucky River bridge at Carrollton, $1,824,000; Cumberland River bridge at Smithland, $460,000; Green River bridge at Calhoun, $450,000; Ohio River bridge at Ashland, $1,200,000.

Highway Suspension Bridge to Be Built Across Penobscot River

Plans and surveys are being made by Robinson & Steinman, consulting engineers, New York, for a new state highway suspension bridge to be built over the Penobscot River at Bucksport, Me. A $1,200,000 bond issue for the construction of the bridge was approved by referendum vote, the bonds to be retired by toll charges. The project is under the direction of a commission of seven appointed by the governor which includes the three state highway commissioners.

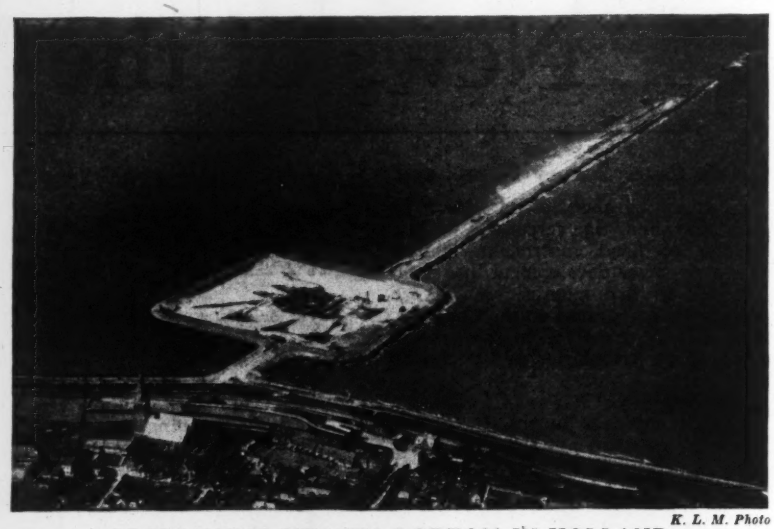
The structure, to be known as the Waldo-Hancock bridge, will cross the west channel of the river near historic Fort Knox, terminating on Verona Island. There is an existing bridge connecting the island to the east shore of the river. At present there is no bridge across the river below Bangor, an inconvenience to coastal highway traffic. The bridge will be of the suspension type, with a span between towers of at least 700 ft., and will have a clearance of 135 ft. over the channel. It will carry a 20-ft. roadway and two sidewalks. Ledge rock on both sides of the stream provides an excellent foundation. The consulting engineers expect to be ready to call for bids on the work within four months.

Status of San Gabriel Flood Control

Although much engineering information on dam foundations was brought out by the reports of recent months on the San Gabriel dam, the actual flood-control program has progressed little. The refusal of the state to permit construction of the proposed high dam on the ground of menace to life and property eliminates the largest single unit of Los Angeles County's flood-control program. Three million dollars has been spent at the San Gabriel parks site, but now a new study of the entire general plan for the San Gabriel River will be required. One item was left open to immediate consideration when the board that advised the state engineer suggested that an earth- or rock-fill dam of conservative design could be built there safely.

Assuming a 300-ft. height as about the limit for a conservative design in such a structure, 80,000 acre-ft. of storage would be obtained. This would be only about one-third the capacity secured by the high dam contemplated up to now. This storage would be expensive, but may be justified as an alternative to abandoning work already done. As to other means for developing larger storage capacity, new studies might result in some change in opinion as to the amount actually necessary for proper flood control and conservation. However, whatever additional capacity is considered necessary apparently will have to be secured at upstream sites. This would be a partial return to the small-check-dam scheme, brought forward several years ago, but finally rejected in favor of one major reservoir with long holdover storage.

It is probable that further development in the whole scheme will be slow, since, for political reasons, the severe setback caused by the forced abandonment of the plan at San Gabriel may result in long controversy in the county board of supervisors before the four-out-of-five majority can be mustered to make the bond money voted for the high dam available even for the study of other possible sites. In the meantime the territory of the lower San Gabriel wash will not have the expected flood protection and can only hope for the rather uncertain security resulting from further seasons of subnormal rainfall. For the several years that the flood-control scheme has been under way this has sufficed, but the disastrous floods of the past make it desirable that something be done before another wet season.



K. L. M. Photo

RECLAIMING THE SEA BOTTOM IN HOLLAND

Beginning a 12-mile dike which will connect Medemblik, in the foreground, with the Isle of Wieringen in the Zuyder Zee, Holland, to reclaim an area of 48,000 acres of the left of the dike. Boulder clay from the sea bottom is being obtained in the inclosed area near the shore, to be used to form the water-tight shell of the dike, which will be filled with sand dredged from the bottom of the sea. This project will be the first to be completed of an undertaking involving the reclamation of nearly 550,000 acres.

Honorary Commission Named to Road Congress

President Hoover has appointed an honorary commission to attend the sixth congress of the Permanent International Association of Road Congresses to be held in Washington, D. C., Oct. 6-13, consisting of the members of the Cabinet and the chairmen of the Senate and House committees on foreign relations, and on post offices and post roads. President Hoover is honorary chairman of the congress, and Roy D. Chapin is the president of the American organizing commission.

Columbia University Offers Short Concrete Courses

Columbia University, New York City, in co-operation with the Portland Cement Association, will offer two five-period concrete laboratory short courses covering the theory and practice of the water-cement ratio method of securing concrete of predetermined strength. The two courses will be identical and are intended for engineers' and contractors' superintendents who have not had an opportunity to study the water-cement ratio method in detail. L. E. Andrews, of the Portland Cement Association, and Prof. A. H. Beyer, civil engineering department, Columbia University, will give the courses. The only charge will be a laboratory fee of $5. Applications and information can be secured from L. E. Andrews, Portland Cement Association, 347 Madison Ave., New York, N. Y. The first course will be given the evenings of Feb. 4, 6, 11, 13 and March 11; the second will be given Feb. 25, 27, March 4, 6 and April 1, also in the evenings.

Brief News

THE WATER DIVERSION SUIT of the State of New Jersey against the State and City of New York will be laid before a special master to be appointed by the U. S. Supreme Court, according to a decision made by that body Jan. 20. The special master will probably be appointed in the near future.

A FEDERAL APPROPRIATION of $1,660,000 for the reconstruction of roads and bridges in Alabama which were damaged by floods in 1929 was passed Jan. 17 by the U. S. Senate. By the terms of the bill, the state must provide an equal sum for this purpose before the money becomes available.

EXCAVATION for the south pier of the new $4,500,000 Aurora Ave. bridge across Lake Union at Fremont, Wash., was begun on Jan. 1 by the Pacific Bridge Company. One year is allowed for the construction of the piers.

BIDS WERE OPENED on Jan. 10 by the commissioner of highways in the State of New York for the construction or reconstruction of 62.92 miles of highways and three bridges. The low bids totaled $2,430,998.

A PARTY of ten men representing the firm of Allen & Garcia, consulting engineers, of Chicago, is en route to Russia to take charge of the modernization and rehabilitation of coal mines in that country. Another party of 25 is to follow about March 2.

A PRELIMINARY PERMIT has been granted the Mississippi Power Company, Gulfport, Miss., for a proposed power development on the Tennessee River in the vicinity of Riverton, Ala., between the government navigation dam No. 1 and the Wilson dam.

COMPLETION of the Morony hydroelectric plant of the Montana Power Company is expected some time in February. The new plant, rated at 45,000 kw., is located on the Missouri River, 15 miles below Great Falls, Mont.

PITTSBURGH TERMINAL IMPROVEMENTS will account for two-thirds of the $3,000,000 improvement budget for 1930 announced by the Pittsburgh & Lake Erie Railroad.

A SPECIAL ELECTION will be held in Phoenix, Ariz., Feb. 11 on bond issue proposals of $2,636,000 for water-supply purposes and $817,000 for sewer and sewage-disposal purposes.

ACCIDENT INSURANCE to the amount of $1,000 for every paid-up member was put into effect Jan. 1 by the American Association of Engineers.

ENGINEERING AND LAW will be combined in one course beginning next year at the University of Michigan. The plan provides for three years of study in the engineering school, followed by three years in the law school and degrees in both. The engineering degree will be given after completion of one year in law school. The program has been arranged to give students the engineering foundation without requiring them to take the highly specialized subjects of the fourth year in the engineering school.

EIGHTY MILES of 110-kv. transmission line between White Salmon and Yakima, Wash., to constitute the first link in tying in the systems of the Washington Water Power Company, Spokane, and the Northwestern Electric Company, Portland, will be built during 1930. This transmission line, which is to cost $1,100,000, will connect the Condit plant of the Northwestern Electric Company with the Yakima-Walla Walla system of the Pacific Power & Light Company.

THE SOUTHERN SECTION of the Persian Railroad, which is being constructed from the Caspian Sea to the Persian Gulf, was opened and dedicated on Jan. 7. The road, which is standard gage, is the only trunk road in Persia. When completed, it will be about 1,000 miles long and will decrease the travel time from six weeks by caravan to 24 hours by rail.

WESTERN COLORADO is threatened with serious shortage of water in 1930 on account of unusually light snowfall this winter. Unless heavy snowstorms occur during the next few months it is predicted that irrigation and water-power facilities will be badly impaired next summer and fall. Snow lies less than a foot deep at altitudes of more than 10,000 ft. Usually these places are heavily banked early in November.

The Business Outlook

There is fairly definite evidence of an upturn in business activity in the records for the first two weeks of January. Encouraging signs are: Steel production has risen somewhat abruptly; building contract awards are distinctly larger; coal production is running high; non-bulk car loadings have made a fairly good first-week upturn; and business transactions by check outside the stock-trading cities shot up astonishingly for the first week of the year, higher than for any week in 1929 and 7 per cent above last year at this time. Sufficient evidence is now in to assert that general buying power was not greatly hurt by the market crash, that the recession following the boom expansion of the first half of 1929 has probably gone as far as it will go, and that renewed buying activity is beginning to get under way.

—The Business Week, Jan. 22.

Floods Cause Damage in Indiana and the South

High water in the Wabash and White rivers, augmented by ice jams, has caused the flooding of approximately 75,000 acres of farm lands in southern Indiana in the vicinity of Vincennes during the past week. In the Wabash a level of 1 ft. above the 1913 flood was reported. A number of small towns were affected, and it is believed that much livestock has been lost.

Conditions in the lower Mississippi Valley continue practically unchanged from the report given last week. Ten minor levee breaks have been reported from the St. Francis River region, resulting in the flooding of about 10,000 acres. More serious is the break in the levee confining Big Lake, Ark., which drains through Little River into the St. Francis. Here it is estimated that water has already covered more than 150,000 acres. However, as the water level has apparently reached its peak, little further damage is expected.

Canadian Railway to Build Extension

Premier Ferguson, of Ontario, announces that the Temiskaming & Northern Ontario Railway will be extended from its present terminus at Coral Island to Blacksmith Rapids, the center of the new lignite coal fields, a distance of about 30 miles. The work will be started as soon as weather conditions permit and will be completed some time next summer. The plans include a further extension toward James Bay, with the intention of reaching Moose Factory in about a year. Several routes for the road beyond Blacksmith Rapids have been proposed, but a definite decision as to which will be used has not yet been made.

California Members Appointed to Water Resources Commission

California members of the Federal and State Water Resources Commission have recently been appointed by Gov. C. C. Young. George C. Pardee, Oakland, former governor of California and now president of the board of directors of the East Bay Municipal Utility District and chairman of the state board of forestry, will serve as chairman of the commission. The other members are: William Durbrow, Grass Valley, for many years president of the California Irrigation Districts Association; B. A. Etcheverry, Berkeley, professor of irrigation, University of California; Alfred Harrell, Bakersfield, publisher, director of the state Chamber of Commerce; W. B. Mathews, Los Angeles, member of the Colorado River Commission and chief counsel of the Los Angeles Bureau of Water and Power; Warren Olney, San Francisco, attorney and former associate justice of the State Supreme Court; F. F. Weymouth, Los Angeles, former chief engineer of the U. S. Reclamation Bu-

reau and now chief engineer of the Metropolitan Water District of Southern California; William J. Carr, Pasadena, member of the state railroad commission; and Bert B. Meek, Oroville, state director of public works. Edward Hyatt, state engineer of California, will serve as secretary.

The commission, which was formed to study and devise a plan for the maximum conservation of the state's water resources, is to make a full report of its findings and recommendations to Governor Young Dec. 30, 1930.

50-Year Water-Diversion Program Planned by Denver

A program of water diversion that contemplates 50 years for its complete fulfillment has been announced by the Denver board of water commissioners. The plan encompasses not only the Moffat tunnel pioneer bore but also a 22.81-mile tunnel from Dillon to Grant, Col.

The Dillon-to-Grant water tube, to be driven through the continental divide, will divert waters of the Blue River on Colorado's western watershed into the North Fork of the Platte River, thence by gravity to the Two Forks dam, construction of which is under consideration by the Denver water commissioners and the site of which has been filed upon as a power site with the Federal Power Commission. The great tunnel is scheduled to be driven over a period of twenty years. Later, it will be enlarged and lined with concrete. On completion, the Blue River project will supply Denver, engineers estimate, with 218,000 acre-ft. of water. A retaining system to impound these waters will probably add more than $6,000,000 to the cost.

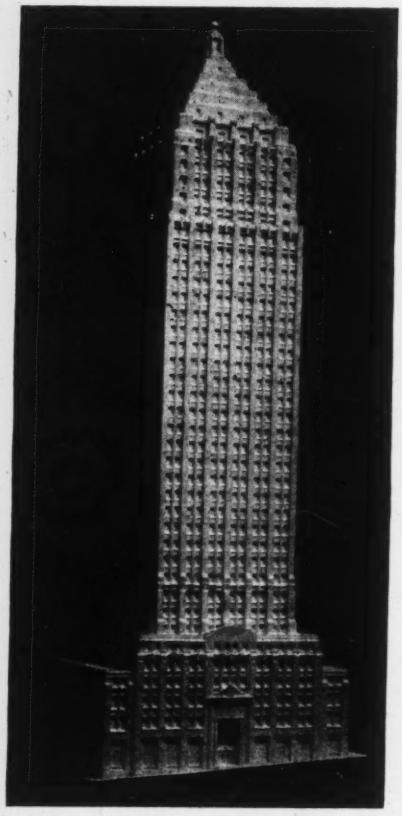
More imminent is the work to be done in connection with the Moffat tunnel water bore involving domestic and irrigation supplies from the Fraser and Williams Fork. The city of Denver has appropriated $50,000 annually to be used in concreting the pioneer bore. Within ten years, it is estimated, Denver and surrounding territory will receive 100,000 acre-ft. annually from this source. A retaining and distribution system to accommodate this schedule is estimated variously at from $15,000,000 to $20,000,000. This part of the commissioners' program has been bitterly attacked by the Denver *Post* as far too expensive and unnecessary, in view of plentiful water rights owned by the city which can be supplied from the Blue River.

The Denver water commission recently took over maintenance of the Moffat tunnel pioneer bore and bought equipment costing more than $65,000 for its upkeep. At the Dec. 17 meeting, payment of $4,900 for various buildings at West Portal, including machine and blacksmith shops, domiciles for workers, storage and powder houses, was approved. Preliminary work of lining the tunnel will begin in 1930.

Plan Memorial in Honor of Pioneer Railroad Engineer

Funds are being collected from employees in all branches of the Southern Pacific Company's organization for the purpose of financing the erection of a monument to Theodore D. Judah, promoter, first chief engineer and one of the founders of the Central Pacific Railroad, parent organization of the present Southern Pacific Company. He made the preliminary surveys for the railroad route over the mountains eastward from Sacramento, Calif. The monument is to be erected in the park facing the Southern Pacific Company's station in Sacramento, according to the plans announced. It is to be finished in time to be unveiled during the annual convention of the American Society of Civil Engineers, which will be held in Sacramento April 24-26, 1930. J. H. Kirkbride, engineer of maintenance-of-way and structures, heads the committee which is in charge of securing the funds.

TO BE PITTSBURGH'S HIGHEST BUILDING



Architect's drawing of the new 37-story office building to be erected in Pittsburgh, Pa., by the Gulf Refining Company. It will be 575 ft. high with a base course of granite and the remaining part of the exterior of Indiana limestone. The architects are Trowbridge & Livingstone, New York City, with E. P. Mellon, of Pittsburgh, as associate.

Baltimore Employs Consultants on Municipal Projects

Announcement has been made by the Board of Estimates of the City of Baltimore, Md., of the appointment of three engineering firms to serve as consultants on current municipal projects. The J. E. Greiner Company will design, plan and supervise the work in connection with the extension of Howard St. The firm of Whitman, Requardt & Smith has been selected to serve on the project dealing with the Bath St. viaduct. Ezra B. Whitman, senior member of the firm, was formerly water engineer of Baltimore and has also been chairman of the Maryland Public Service Commission. Henry G. Perring, who is a former chief engineer of the city and was formerly supervising engineer of the Public Improvement Commission, will serve in connection with a bridge to carry Loney's Lane over the tracks of the Pennsylvania Railroad.

It is estimated that the cost of these projects will be close to $3,000,000.

To Explore San Francisco Bay Bridge Sites

A contract has been let to the Duncanson-Harrelson Company, of San Francisco, for the making of borings to determine foundation conditions in San Francisco Bay along several of the suggested sites of the proposed bridge to connect San Francisco and Alameda counties. These data will be used in the engineering studies of the bay area being made as a part of the investigation that is under way by the joint federal, state and local San Francisco Bay Bridge Commission. Borings will be made along the suggested bridge sites from Goat Island to Telegraph Hill; from Rincon Hill to Goat Island; from Rincon Hill to the Alameda Mole, and in adjacent territory. The contract was let on a unit price basis, with cost estimated at $26,829.

Prequalification Plan Adopted by Tennessee

The Tennessee State Department of Highways and Public Works on Jan. 1 adopted a prequalification plan whereby it will be necessary for a contractor to have on file with the department a new form of questionnaire before he can obtain a proposal for use in bidding. If previous work has not been satisfactorily handled or if claims have been filed with the department either for labor or for material, the contractor is to be advised that his standing will be considerably lowered. No contractor who has never had a general contract with the department will be awarded a contract in excess of 10 miles in length and no contractor who has not successfully completed 50 per cent of his first contract will be considered.

WASHINGTON NOTES

By Paul Wooton
Washington Correspondent

Changes in Flood-Control Plans Under Consideration — Opinion Divided on Contract Provisions

MAJOR alterations in the Jadwin flood-control plan are being considered by the army engineers, according to recent statements by the Secretary of War. As the result of the verdict secured by residents in the floodway basins, it has become apparent to the War Department that the adopted project cannot be carried out without the enactment of additional legislation or without fundamental changes, the Secretary said.

In making these comments, Secretary Hurley pointed out that the court decision holding that the government must pay for flowage rights in the floodway areas on the west bank has made it necessary to seek further legislation in view of the larger expenditures that will be required. Under the Jadwin plan the purchase of flowage was not contemplated in connection with the west bank floodways. The prices being asked in the floodway areas are too high to permit payment from the present sums appropriated or authorized, the Secretary stated. It is therefore necessary to obtain greater appropriations from Congress or to modify the existing plan so as to make other provision for the west bank diversions. The survey now being conducted by General Brown, Chief of Engineers, is being directed along these lines, the Secretary stated. Further consideration is being given to reservoir proposals, and attention is also being given to the practicability of a controlled and regulated spillway clear through to the Gulf on the west bank.

Spillway Widths

Statements have been made by the army engineers, however, that they do not consider a controlled spillway in this section to be feasible. They have expressed the opinion that it would be less expensive to use the wide floodway—30 miles across in some places—than to build controlling works clear through to the Gulf for a more narrow channel. This statement is made, of course, in realization of the fact that by reason of the court decision it will now be necessary to purchase flowage rights.

As another reason why a resurvey is being made in the floodway section, Secretary Hurley cited the case of the citizens of Monroe, La. These people have informed the War Department that they would be less exposed to flood danger if nothing were done than they would by the diversion contemplated in the adopted project.

Alaskan Highway Plan Received Favorably

An encouraging reaction to the bill introduced into Congress by Delegate Dan A. Sutherland of Alaska, providing for a study regarding the construction of a highway connecting the northwestern part of the United States, British Columbia, Yukon Territory and Alaska in co-operation with the Dominion of Canada, was shown by the House Committee on roads at a hearing held Jan. 16. President Hoover's attitude toward the proposed road, as reflected by the Bureau of the Budget, is favorable, provided no appropriation is called for.

The cost of the contemplated highway would fall largely upon Canada, as most of the construction would occur in her territory. Two routes have been proposed—one approximately 900 miles long, following up the valley between the Rocky Mountains and the coastal range, which is of particular interest to the United States because of its proximity to Alaskan territory; the other, with an estimated length of 1,400 miles, would follow a more inland track. Both routes would terminate at Fairbanks, Alaska. Only about 225 miles of construction would be required of the United States in connecting Fairbanks with the Canadian end of the road. The annual Alaskan road appropriation, it is said, is sufficient to cover such construction. Terrain over which the coastal route would be built is rolling, with a summit less than 2,500 ft. above sea level.

The Prime Minister of British Columbia and Mackenzie King, with whom the president of the board of road commissioners of Alaska has had conversations, are understood to be favorably inclined toward the construction of this highway. No extensive road-building program has been undertaken by Canada since the war, although large projects had been carried out before then. Estimates have placed the cost of this road at $12,000,000, of which approximately $11,000,000 would have to be borne by Canada. Suggestions have been made that the road be built of gravel until flow of traffic warrants more permanent construction.

Government Contract Requirements

Representatives of the various government departments appeared before the House judiciary committee during a recent hearing on the Cramton public contract act and urged immediate action on the legislation. The committee was informed that the department heads desire that the provisions of the bill be retained that make it permissible to accept other than the low bidder in cases where it appears to the interest of the government to do so. The discretionary powers in this connection would be exercised by the department heads.

The committee was also informed that departmental officials believe that the section should be left intact that allows government officials in charge of public construction to remit the payment of liquidated damages for delays in cases where they believe it is just to do so. The general accounting office opposes both the remittance of liquidated damages and the award of contracts to other than the low bidders, it was brought out at the hearing.

Representative Cramton of Michigan, author of the bill, informed the committee that the need for legislation to unify contract requirements is so great that he is willing to sponsor the measure even if it is necessary to leave out the sections opposed by the comptroller-general.

The Cramton public contract act sets up specific provision for authority to make contracts on behalf of the government for advertising for bids, for publication of advertising of specifications, for awards of contracts, for forms of contracts, for filing of contracts, for payments, for security and bonding of contractors, for hours of labor employed by contractors, for transfers of contracts, for settlements and suits and for preference in the use of domestic materials and supplies.

Society Calendar

AMERICAN CONCRETE INSTITUTE, Detroit; annual convention, New Orleans, La., Feb. 11-13.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, Chicago; annual meeting, Chicago, Ill., March 11-13.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; spring meeting, Sacramento, Calif., April 23-24.

AMERICAN WOOD PRESERVERS ASSOCIATION, Chicago; annual meeting, Seattle, Wash., Jan. 28-30.

ASSOCIATION OF HIGHWAY OFFICIALS OF NORTH ATLANTIC STATES, Trenton; annual convention, Syracuse, N. Y., Feb. 19-21.

ENGINEERING INSTITUTE OF CANADA, Montreal; annual convention, Ottawa, Ont., Feb. 12-14.

NATIONAL SAND AND GRAVEL ASSOCIATION, Washington; annual meeting, Memphis, Tenn., Jan. 28-30.

ENGINEERING SECTION of the American Association for the Advancement of Science met Dec. 28 and 30, 1929, at the Des Moines convention of the main association. Half a dozen papers of interest to civil engineers were presented as follows: "The Placement of Engineers Before and After Graduation," by John R. Bangs, Jr., Cornell University; "The Statistical Element in Mechanics of Materials," by F. B. Seely, University of Illinois; "The Effect of Vibrations on Masonry Structures and Foundations," by C. C. Williams, University of Iowa; "The Government Mapping Program in a Map-Minded Age," by J. S. Dodds, Iowa State College; "Hydraulic Laboratory at Iowa University," by S. M. Woodward, University of Iowa; "Results of Research in Highway Economics," by T. R. Agg, Iowa State College.

IOWA ENGINEERS will gather in Council Bluffs for meetings of the Iowa section, American Water Works Association, Feb. 4, and of the Iowa Engineering Society Feb. 5-7.

MICHIGAN ENGINEERING CONFERENCE will be held at the University of Michigan, Ann Arbor, Jan. 30-31.

NATIONAL DRAINAGE CONGRESS will hold its nineteenth annual session at St. Louis, Mo., Feb. 19-21.

NORTH CAROLINA ENGINEERS will meet in Raleigh Jan. 24-25 under the auspices of the North Carolina Society of Engineers, the North Carolina section of the American Society of Engineers and the Raleigh branch of the American Society of Mechanical Engineers.

ROCKY MOUNTAIN SECTION, American Water Works Association, will hold its annual meeting Feb. 13-14 at Denver. Dana E. Kepner, Denver, is secretary.

TEXAS WATER WORKS SHORT SCHOOL for water and sewer plant operators will be held Jan. 27-30 at Abilene, Tex.

Personal Notes

THORNDIKE SAVILLE, chief engineer of the division of water resources and engineering of the North Carolina department of conservation and development, has resigned his position, explaining that the restrictions of the state budget bureau made it impossible for him to continue his work efficiently. The board of directors of the department, it is authoritatively stated, has asked him to reconsider and has refused to accept his resignation.

CLYDE L. SEAVEY, a member of the California Railroad Commission since 1923, has been elected president of that body in conformity with the policy followed by the commission in recent years of rotating the presidency among its members. He succeeds Thomas S. Louttit, who served as the presiding officer of the commission during 1929. Mr. Seavey at one time served as city manager of Sacramento, Calif.

JOSEPH J. JESSUP, for the past seven years consulting engineer with offices in Los Angeles and San Francisco in association with C. C. Kennedy, has been appointed city engineer of Los Angeles, effective Jan. 16. Mr. Jessup succeeds John C. Shaw.

PERCY L. REED, professor of civil engineering, University of Florida, was appointed on Jan. 13 acting dean of the college of engineering to succeed the late Dr. Benton. Professor Reed, a graduate of Lehigh, has been with the University of Florida since 1920.

OSBORN ENGINEERING COMPANY, Cleveland, has reorganized and elected the following officers: president, P. P. Ebans; vice-president, E. H. Birney; treasurer, T. T. Hubbard; secretary, Kenneth H. Osborn.

A. N. CARTWRIGHT, general superintendent of operations, West Penn Power Company, Pittsburgh, has been promoted to operating vice-president in charge of all maintenance and engineering having to do with generation, transmission and distribution.

W. R. LADUE, designing engineer of the Akron (Ohio) city water department, has been made assistant superintendent, succeeding ALBERT S. HIBBS, who has resigned to become assistant superintendent of the Cincinnati water department.

SAMUEL E. BERKENBLIT, structural engineer, Chicago, will go to Russia as architect and engineer for the Allen & Garcia Company, Chicago, in the development of coal mines in the Donietz basin, at Kharka, Russia.

HENRY R. LORDLY has been awarded the Perry F. Nursey memorial premium for 1929 by the Council of the Society of Engineers, London, England, for a paper on the waterproofing of concrete structures. This premium is awarded annually for to the author of a meritorious technical paper adding to engineering knowledge. Mr. Lordly was formerly engineer of design and construction on the Lachine Canal for the Canadian Department of Railways and Canals, and is now attached to the technical service of the city of Montreal. In 1920 he was McGraw fellow in engineering at Cornell University.

W. R. HOLWAY, consulting engineer, of New York City, has opened a branch office in Tulsa, Okla., where he has been retained to make a report on the future water supply of Tulsa and to design and construct such work as is necessary during the next four or five years. Mr. Holway has recently returned from Russia, where he went to make a report on the new water supply of Moscow.

CHARLES DELEUW & COMPANY, on Jan. 1 succeeded the partnership of Kelker, DeLeuw & Company, consulting engineers, Chicago, organized in 1919. No change is noted in the firm's policy or practice, the corporation affording an opportunity to recognize the work of members of the staff active in promoting the firm's interests for ten years. Among these members are C. E. DeLeuw, W. C. Davis, L. H. Cather and T. E. Flanigan. R. F. Kelker retires from the firm, but retains offices with it and will be allied with its interests to such extent as his personal engagements may permit.

MORTIMER ELWYN COOLEY, dean emeritus of the college of engineering, University of Michigan, has been chosen by the Washington Award Commission (made up of representatives of the Western Society of Engineers and the four founder societies) to receive the award for 1930. The presentation will be Feb. 24 in Chicago. The award is given for "accomplishments which pre-eminently promote the happiness, comfort and well-being of humanity." Previous recipients are as follows: Herbert C. Hoover, Robert N. Hunt, Prof. Arthur N. Talbot, J. Waldo Smith, John W. Alvord, Orville Wright and Michael I. Pupin.

Three Detail Forecasts of 1930 Construction

Authorities heard from thus far this year appraise the 1930 construction program at approximately nine billion dollars. The latest forecast was issued by Secretary Lamont on Jan. 19 and places public works and utilities at $6,574,999,900. This, says Mr. Lamont, does not include the outlay for residences, commercial and industrial buildings and other private operations, which last year reached more than three billions. Thus the total budget is at least $9,600,000,000.

The public works estimate is based on reports from the governors of 26 states ($1,778,742,901) and partial returns from the other states ($1,275,000,000) plus a federal budget of $271,257,000. The complete estimate is given in Table I.

Two other detailed forecasts have been issued this month, dealing chiefly with the building outlook. That of the *Architectural Forum* (Table II) is basically a survey of work on the boards in architects' offices. That of the Copper and Brass Research Association (Table III) is based on a study of available statistics. Table IV compares the detailed building figures on these two surveys.

TABLE I—DEPARTMENT OF COMMERCE

Buildings and other private (1929)	$3,000,000,000
Public works for states	3,053,742,900
Federal work	271,257,000
Utilities:	
Class A railways	1,050,000,000
Electricity, gas, street railways	1,400,000,000
American Telephone & Telegraph Co.	700,000,000
Other	100,000,000
Total	$9,574,999,900

TABLE II—ARCHITECTURAL FORUM

Buildings:	
Designed by architects	$5,028,896,000
Not so designed	1,972,000,000
Total	$7,000,896,000

TABLE III—COPPER AND BRASS RESEARCH ASSOCIATION

Buildings	$7,263,000,000
Public works	1,500,000,000
Total	$8,763,000,000

TABLE IV—BUILDING FORECAST

Estimate for 1930, in Millions of Dollars

	Architectural Forum	Copper and Brass Research Assn.
Commercial	$982	$1,162
Hotels	394	167
Public	319	145
Religious	217	174
Educational	641	560
Hospitals	371	202
Industrial	459	820
Recreational	496	218
Residential	1,150	3,815
Other	1,972	....
Total	$7,001	$7,263

Costs and Contracts

E. N.-R. Index Numbers

Cost		Volume	
Jan. 1, 1930	**208.96**	**December, 1929**	**166**
Dec. 1, 1929	209.46	November, 1929	245
Jan. 1, 1929	209.40	December, 1928	244
Average, 1929	207.02	Average, 1929	317
Average, 1928	206.78	Average, 1928	287
1913	100.00	1913	100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of Jan. 23, with some comparisons, total as follows:

(In Thousands of Dollars)

	Jan. 23, 1930	Jan. 16, 1930	Jan. 24 1929
Buildings:			
Industrial	$7,835	$18,546	$1,355
Commercial	19,268	22,038	35,780
Streets and roads	5,222	7,449	6,918
Other eng. constr.	16,898	9,132	21,712
Total	$49,223	$57,165	$65,765
Total, all classes, Jan. 1 to Jan. 23:			
1930			$188,720
1929			345,320